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CONTENTS.

EDITORIAL: PAGE
Paragraphs ... 57

ILLUSTRATED ARTICLES:
Long Distance Transmission of Power, by E. Arnold ... 58
Electricity at the World's Fair ... 60
The Electrical World's Digest of Current Technical Electrical Literature, compiled by Carl Hering ... 65
The Oconto Incandescent Lamp Case—II ... 68
The Eclipse Exhaust Pipe Head ... 72
An Automatic Short Circuit Alarm Bell ... 72
Portable Electric Fan Outfit ... 73
The General Electric New Controller ... 72
An Improved Friction Clutch Pulley ... 73
A New Conductivity Bridge ... 73

MISCELLANEOUS:
Single Phase Alternating Current Motors, by Brown, Boverie & Co ... 58
Freaks of Lightning ... 58
Magnetic Pulleys, by W. E. Harrington ... 58
A Spanish Water Power Plant ... 59
Discussion of Electrical Congress Programme ... 63
A One-Volt Standard Cell ... 67
The Variation of Economy of the Steam Engine Due to Variation in Load ... 67
The Schefbauer Safety Trolley Fittings ... 73

FINANCIAL INTELLIGENCE, 74; Affairs of the Companies, 74; New Incorporations, 74.

SPECIAL CORRESPONDENCE: New York Notes, 74; Canadian Notes, 75; New England Notes, 74; Western Notes, 75.

NEWS OF THE WEEK: The Telephone, 75; Electric Light and Power, 75; The Electric Railway, 76; Legal Notes, 76; Pittsburgh Notes, 75; Miscellaneous Notes, 76.

TRADE AND INDUSTRIAL NOTES ... 76

BUSINESS NOTICES ... 76

Our Patent Record. OWING to further delays in the Patent Office we are again unable to present our patent record, since neither the patents which should have been issued on July 4, nor those bearing date of July 11, have yet been given to the public. The difficulty, it is stated, is due to the fact that the contract for the photographic reproduction of the patent drawings has been taken away from the firm that has so faithfully and admirably performed this work for a number of years and placed it in new hands, presumably from political reasons. This state of affairs is to be greatly regretted, for this department of the government should most assuredly be removed from every suspicion of politics.

A Popular Electrical Congress. THE several electrical congresses which have heretofore met to discuss and take action on electrical units have been composed of but a few members, representative of the higher branches of electrical science, but we learn that over a thousand invitations have been issued for the electrical congress to be convened at Chicago, thus giving it a popular character lacking in former ones. In order that the various matters to be considered may be discussed with greater profit we call the attention of the members to the various articles and abstracts of foreign papers and discussions that have appeared in THE ELECTRICAL WORLD during the last three months, which exhaustively cover the entire field. Among the subjects to which the particular attention of the popular branch of the congress should be given are the definition of the candle power of arc lamps (see THE ELECTRICAL WORLD of April 29, May 6 and July 15, 1893), and the adoption of a millimetre wire gauge. Both of these questions are perhaps of more practical importance than many others in the proposed programme, and appeal particularly to the membership of the branch representative of practical electrical engineering. We have reason to believe that a proposition leading to the adoption of a millimetre scale will be favorably received by the Chamber of Delegates.

Long Distance Transmission of Power. IN THE ELECTRICAL WORLD of July 2, 1892, we gave the first data published relating to the Frankfort-Lauffen long-distance transmission, and in another column Mr. E. Arnold gives the same data with additions under fourteen new heads, besides other interesting information, thus furnishing the most complete statement yet made. Why the complete data from the elaborate trials made have not yet been published is inexplicable unless, as has been hinted, it is being suppressed on account of defects in the efficiency of one part of the apparatus used. The statement of Mr. Arnold that the static effect on the long line never gave rise to any difficulties is an important one, and though at variance with the accepted belief, the deductions given strongly support it. While, as stated by the writer, it is theoretically possible to balance the effect of the static charge of a long line by means of a certain amount of self induction or by the use of a proper frequency, whether this can be done practically and for all loads still requires demonstration. The great importance that long-distance transmission is assuming will doubtless soon cause the various matters now in doubt to be definitely settled, but had the full report of the Frankfort commission been published in due time, as it should have been, it is probable that knowledge on the subject would be considerably advanced beyond its present point.

Misleading Statements. MUCH mischief is often done by statements which are either carelessly made or are incomplete, the result being that they mislead one, or, what is worse, give an unfair opportunity to those who are only too ready to make use of them for improper purposes. On several occasions we noticed that data was given, for instance, regarding a motor to operate a crane, together with the weight which is lifted and the speed with which it is to be raised, thus giving the mechanical and hydraulic engineers, who have learned the fact that 746 watts make a horse power, an opportunity to calculate the efficiency of the system. As usual in any well constructed motor, it is built to stand a greater current than what is required for normal working—or, in other words, the electrical constructor, like other engineers, introduces a certain factor of safety, even though it need be, we are glad to say, exceedingly small as compared with the factors of safety ever used by mechanical, civil or other engineers. The current given in connection with the motor is, therefore, usually larger than that which is required when in the act of lifting the weight, and if the efficiency is calculated from that data it naturally becomes much lower than what it really is. As hydraulic engineers, who recognize that electrical systems are beginning to compete quite seriously with the hydraulic, are quick at making use of such slips on the part of the electrical constructor, perhaps intentionally or perhaps not, it will be greatly to the interest of those who introduce electrical apparatuses to be careful how they give the data. It would be but little more trouble to state that the motor for the crane would stand so-and-so many ampères in case of emergencies, but when under normal conditions it actually consumed only so-and-so-many ampères.

The Oconto Incandescent Lamp Case. IN our last issue we gave the substance of the complainants' case; in this the other side is presented, not fully by any means, but as fully as time and space would allow. The testimony of Wm. A Goebel, a portion of which only is given, is considered the most remarkable feature in the whole series of litigations, corroborating as it does so many details of previous testimony and filling so many gaps with new links supposed to have been forever lost. Defendants' counsel claim that they would have been willing to have rested their case on this testimony alone, so strong do they consider it. What must strike the reader as the most remarkable part of this testimony is the strength developed for the defense by the cross-examination of the witness by the complainants. It will be remembered that it was claimed by the friends of the complainants that if they could only get the defendants' witnesses under cross examination they would break down the credibility of their story. All of the new testimony for the defense in this case, covering some 650 pages of the printed records, was given under oath and the witnesses were subjected to a most rigid cross examination. Not only was the defense not discredited thereby, but materially strengthened. The claim that lamps Nos. 1, 2 and 3 were made by Henry Goebel, Jr., that lamp No. 4 was made by Heger, and that tool No. 6 was made by Korwan, upon which the complainants made their main fight, seems to have been fully met by the depositions of Wm. A. Goebel and Mr. and Mrs. Opry. The claim that witnesses for the defense had been caused to place their signatures to statements which they never made, which was a serious charge, was in some cases, at least, entirely disproved by subsequent testimony of these same witnesses, thus throwing the onus of the charge upon those who made it. The counter-charge by the defendants, that the complainants had used undue influence with their witnesses, while perhaps not fully proved, was sufficiently supported by circumstantial and other evidence to place the accused clearly on the defensive. The general opinion seems to be that the defense is much stronger to-day than at the close of the St. Louis trial, and the defendants are consequently more hopeful. As to the law bearing on the case, it is contended by the complainants, and was so held by Judge Colture, that in order to have the restraining order set aside the defendants must prove the prior existence of the Goebel lamp beyond a reasonable doubt. The defendants, on the other hand, contend that while they have proved this, such positive proof is not necessary in a preliminary hearing; that it is only required in the final hearing. They claim that all that is required of them is to raise a fair presumption of the truth of this Goebel story. This latter was the view of Judge Hallet. Judge Seaman had expected to render his decision in the case on Monday, July 17, and interested parties were in court on that date, but he announced that he would defer his decision until Thursday, July 20.

British Conservatism. THE conservatism of Britons does not render the life of the promoter of new enterprises in Great Britain a happy one. When anything new is proposed, instead of being welcomed and treated with indulgence, as in America, the innovation, on the contrary, is looked upon with suspicion and an attitude adopted toward it similar to that of the wolf toward the lamb in La Fontaine's fable. When the steam railroad was proposed, the public was informed that the smoke would kill the birds, foxes and pheasants would be frightened away from the vicinity of a road, horses would throw their riders, cows would cease to yield their milk, and the smoke and noise would disturb the quiet and comfort of the entire kingdom. Appealing to another weakness, the frugal Britisher was informed that horses would become valueless, oats and hay would cease to be marketable, and that various employments connected with horses, coaches and their equipments, becoming obsolete, would entail great hardships; more to the point, it was asked what was to be done with those who had money invested in turnpikes, and pointed out that iron would be raised in price a hundred per cent. When a tunnel between France and Great Britain was proposed, the project was promptly squelched, principally through the arguments of General Wolseley, who perhaps thought it would be more difficult to keep the Frenchmen at bay at the mouth of the tunnel than it was to win his Egyptian victories. Coming to the age of electricity, the introduction of electric lighting was the signal for another uprising, and the result was that the new industry was promptly throttled, for six years at least, by the Board of Trade rules of 1882. Recently an important electric railway enterprise was successfully attacked on the ground that its operation would interfere with some electric instruments in a couple of college laboratories which happened to be near its proposed line. At present a parliamentary committee, on the application of a telephone company, is considering the question whether the said company shall own the whole earth, considered as a ground return, or whether the electric railway industry shall be permitted to take its development along natural lines. The case is being hotly contested, and although various municipal officers have appeared for the people, this aspect of the case, which would be the deciding one with us, seems to be viewed as of secondary importance, vested rights and purely scientific opinions appearing to be deemed more worthy of consideration. On the one hand are the delicate instruments employed in telephony and telegraphy, sensitive to the slightest electrical fluctuations, and which can be operated under all circumstances better with a metallic return; on the other is the electric railway, of benefit to thousands where the telephone is to scores, and whose financial operation in most cases would be impossible under the restrictions which its telephonic rival would impose. We await the decision of the inquiry with interest, and trust, for the sake of the electrical profession at large, that fair play and the modern spirit will not again be relegated to the rear.

Single Phase Alternating Current Motors.

To the Editor of The Electrical World:

The course which has recently been taken by the controversy as to the priority in the field of single-phase motor construction induces us to send you the following statements, hoping that you will give them publicity in your columns.

After the publication of a description of his new alternate current motor by Mr. C. E. L. Brown, Herr von Dolivo-Dobrowol-ky tried to show that such motors were entirely useless in practice, while Herr Arnold, of the Maschinenfabrik Oerlikon, asserted that the motor of Mr. Brown was nothing new at all, but had been known for years.

Now, since both of these assertions have been discredited, Herr Behn-Eschenburg, also of the Maschinenfabrik Oerlikon, discovers that he himself invented this motor (which according to Arnold had long been known) as early as the summer of 1892, and that Brown has simply copied it.

The following will, however, set right these assertions in a very simple manner:

If Herr Behn-Eschenburg were acquainted with the tests carried out in Oerlikon, he would know that as early as 1890 and 1891 Brown had already ascertained in the course of his experiments that multiphase motors may be run and even started with only two phases just as well as with three. He also showed that multiphase motors when once started continue to run with one phase only, although, in consequence of their not being designed for it, they gave but little power. Nevertheless, the present alternate current motor of Brown may be said to have been invented in these experiments.

After the founding of this firm we took up energetically the further development of these observations. In October, 1891, we received from Herr Oscar von Miller inquiries for the electrical station at Furstenfeldbruck. This had been intended by Herr von Miller to be on the rotating current system, but we tendered for the simple alternate current, since we declared ourselves in readiness to supply alternate current motors as good as those for rotating current, "which will start themselves and possess neither collectors nor sliding contacts." In answer to a question from Herr von Miller as to how the motors were started, we wrote to him, "The starting is effected without communication of the current by artificially produced difference of phase." At the same time we sent to Herr von Miller a drawing of such a motor, showing Brown's short-circuited rotating part exactly as he constructed it in his multiphase motors.

On Nov. 27, 1891, we sent in our proposals for the electrical station in the town of Chur, for which installation we similarly proposed the simple alternate current on the grounds that "we have succeeded in constructing electric motors for ordinary alternate currents which compare equally with those for direct current as well as those for multiphase alternate current." In the description of the motors the proposal runs as follows: "We supply electric motors for the alternate current which have the peculiarity that they possess neither collectors, brushes nor sliding contacts." Almost the same sentence is to be found in our tender for Ragaz, dated Feb. 2, 1892. For all these stations the Maschinenfabrik Oerlikon had tendered rotating current systems, and it is principally to be ascribed to our proposals that they were carried out with the alternate current.

Herr Oscar von Miller in January, and the promoters of the Ragaz station in February, 1892, had seen such a motor at our works. In the following months such motors were shown by us to a great number of visitors to our works, among whom were many very prominent electricians.

All this is not affected by the circumstance that in the summer of 1892 we had also taken up the construction of synchronous motors for the same reason which appears to still prejudice Herr Behn-Eschenburg against the non-sychronous type. We hoped by the use of synchronous motors to reduce the idle current. Our experience shows us, however, that this desirable result cannot, under the conditions which obtain in practice, be attained with this type of motor, while we have succeeded in so improving the non-synchronous motors that their idle current is remarkably small and that they will start with a moderate increase of current.

From the above it will be readily seen that Mr. Brown did not wait for Herr Behn-Eschenburg, nor till the summer of 1892. We will therefore leave it to the reader to judge of the accusation brought by him against Mr. Brown.

We hope you will find room in your columns to give publicity to these statements. BROWN, BOVERIE & Co.

BADEN, Switzerland, June 30, 1893.

Magnetic Pulleys.

BY W. E. HARRINGTON.

In several of your issues you have referred to the magnetic method of power transmission, for which system the writer holds fundamental patents, and I have just completed a series of tests relating to the same which are exceedingly interesting from the standpoint of a railway man.

As all are aware, the tendency of practice is toward one-motor equipments on street railway cars, but where grades are heavy or trail cars are hauled it is almost imperative at present to have two motors to obtain the necessary traction. If the dead axle could be connected by any simple means to the motor axle, the need of the additional motor would no longer exist.

The magnetic pulley method of transmission enables us to connect the axles as described in an exceedingly simple manner. The Camden Horse Railroad Company, of Camden, N. J., have single-motor equipments, Westinghouse motors, and at certain times, owing to loads, trail cars and condition of track, the wheels of the motor cars "skid"; to overcome this two magnetic pulleys were made, both the same size, 18 inches diameter, 4 inches wide, and also a flexible iron belting 3⅜ inches wide. One pulley was placed on the motor axle beside the motor, and the other pulley was placed in line on the dead axle.

The method of electrical connection being simple, it is easily followed; instead of grounding the motor current direct, the ground terminal of the motor circuit is led to a rubbing contact on the dead axle, thence to one terminal of the magnetizing coils on the dead axle magnetic pulley; the other terminal of the magnetizing coils is attached direct to the rim or face of the pulley (which is insulated from the hub) and the current follows across the belting to the face of the pulley, which in this case is the ground. This arrangement of circuits enables us to do away with rubbing contacts on the motor axle, which otherwise would be troublesome. Since the windings are in series with the motor the magnetic attraction increases directly with the current and varies with the current. When the current is applied to starting the car the magnetic pulleys have their maximum magnetic adherence, and the car wheels which would otherwise skid are now reinforced by the additional traction afforded by what would otherwise be dead wheels, requiring additional power on the part of the motor. The amount of energy required to develop the magnetism is almost negligible; in the test as made the maximum voltage across the terminals of the entire pulley circuit did not at any time exceed 12 volts, which need not be considered in the case of a 500-volt circuit.

In point of fact this question of the consumption of energy to obtain additional traction assumes a new and interesting phase, as in every other form of device heretofore suggested and tried the arrangements cause a certain amount of loss which is a constant factor and militates seriously against them. The only time when a car requires additional traction is chiefly upon starting and when climbing grades; if at all other times the device, which is intended really only to assist in starting and on grades, could be simply disconnected and thrown out of service unquestionably a great saving in energy would be effected, which, with a large number of cars and covering any period of time, say a year, would result in a very material saving. Unless this disconnecting device is simple it had better not be used on the score of the multiplicity of parts. For instance, if bevel gears were used, the only device that could be used to detach and throw one out of service would be a friction clutch; any comment on the disadvantages of such an arrangement would be superfluous.

In the combination as embodied in the magnetic pulley method of transmission all that is necessary to throw the same out of operation is the mere making or breaking of its circuit. Since magnetic pulleys and belting do not depend upon mechanical friction for transmission of force the belt need not be under tension and the face of the pulleys may be lubricated if desired.

In the matter of the test referred to above, the conditions were such as would never possibly occur in practice. The rails immediately under the wheels of the motor axle were carefully and thoroughly greased, and hard wood blocks one inch thick were placed under the dead axle wheels. Upon applying the current to the motor with the magnetic pulleys out of circuit the motor wheels skidded freely; upon throwing the magnetic pulleys into circuit the car started and ran over the wooden blocking with ease. This test was repeated several times, always with the same result. Another test was made even more severe than the above. A trail car with its brakes set was attached to the motor car. Upon applying the current with the magnetic pulleys out of circuit the motor wheels skidded on the greasy rail as before, the car standing still; upon throwing the magnetic pulleys into circuit the car started off. This test was also made repeatedly. The car was then run on the road at different speeds, and the noise made by the belting under the different conditions was of no account.

It is interesting to note that the circumferential torque or magnetic adherence of the belting to the face of the pulley was found to be one pound per square inch of contact per ampère—iron to iron—which, with fifty (50) ampères, the initial starting current of the motors, meant a pull of 2,000 pounds, giving a horizontal effort at the periphery of a 22-inch car wheel of 1,030 pounds.

The very small cost of this arrangement of magnetic transmission is negligible compared to the many advantages. Many roads are now being operated under the most adverse conditions, owing solely to lack of necessary traction. Even the West End Railway of Boston, the writer noticed, suffers from its car motor wheels skidding. The West End is only one road out of the many which appear, to be going back to the single-motor equipment, and if it were not for the almost radical defects of the systems at present in general use, through failure to furnish one-motor equipments with means of connecting axles, many roads not now operating electrically could be so operated and pay dividends.

That the parent companies appreciate this fact may be inferred from the knowledge the public have of experiments made by the General Electric Company with sprocket gearing only this last winter. Sprocket gearing is all right in its proper sphere, but for street car work it is too noisy, and wears out too rapidly. The writer was superintendent of the Electric Railway in Wheeling, W. Va., and had 12 cars equipped with Vandepoele motors on the front platform, and gearing with sprocket chains to the axle. The noise was greater than the old double reduction motor cars, and a chain would wear out in about three to four weeks, always wearing away at that part where the recess in each link rubbed down over the tooth on the sprocket wheel.

We understand that experiments are now being made with rope transmission. C. W. Hunt, in an article on "Rope Driving" read at the Richmond meeting, November, 1890, of the American Society of Mechanical Engineers, states that "a rope one inch in diameter should have a working strain of 200 pounds," this applying for all speeds; a half-inch rope would have a working strain of 50 pounds, the smallest diameter pulley allowable would be 20 inches, and to transmit, say, 2,000 pounds would require a 40-groove pulley having a width of about 30 inches. This would require a tension pulley and carriage, and I would like to see a car under which you would have the room to place all this mechanism.

As for a single motor with bevel gearing or connecting rods, notwithstanding the efforts made to introduce these forms, it has not been demonstrated that the complication and wear involved do not more than overbalance the advantages claimed over the double motor.

Freaks of Lightning.

A recent accident happened in Keighley, in which, among other things, a stone weighing over 100 pounds was carried 20 yards with such force as to shatter itself against a stone wall, while small stones and pieces of glass were found 60 yards away; the inside of the house suggested a dynamite explosion; the most interesting of all was that an iron kettle, supposed to have been held by a woman in the act of filling it from the spigot, was smashed, the woman being stunned, but not killed.

Long Distance Transmission of Power.

BY E. ARNOLD.

At the St. Louis convention of the National Electric Light Association Mr. C. S. Bradley, in a paper on the above subject (see The Electrical World, March 11, 1893, page 178), made the following remarks in reference to static induction in long lines:

"The Lauffen-Frankfort was an extreme case. First, the line was much longer (110 miles or 175 kilometres) than we shall expect for some time to come in practical work; second, the plant was intended for 300 h. p. and a rate of 40 phases per second. Owing to the static effects of 40, the rate had to be lowered to about 23 per second; this obliged them to run the dynamo at very much reduced speed, so that it was capable of only about 100 h. p., and this reduction increased the proportionate effect of the static charge."

This representation of Mr. Bradley does not agree with the Lauffen-Frankfort power transmission, for it was run steadily at 40 phases per second. This fact must be emphasized, because such a low phase rate as 23, which Mr. Bradley gives, is useless for lighting purposes.

This mistake has been possible only owing to the non-publication, as yet, of the report of the testing commission.

Prof. H. F. Weber, of Zurich, was so kind as to put at my disposal the following results of the run on the 14th of October; on the other trial days, during some of which it rained, the same number of revolutions was made.

The static induction of the line has never given rise to any difficulties even with the most varying atmospheric conditions; and this would still have been the case if the phase rate had been materially increased. The capacity of a naked overhead wire from 25 to 35 feet above ground is really so small that even in a system 110 miles long, and where a large amount of energy is transmitted, the static induction is of practically no importance, and at all events it can never amount to an insurmountable obstacle.

An interesting example is the Hochfelden-Oerlikon power transmission, which has already run the Maschinenfabrik Oerlikon continuously for one year. The design and size of generators and transformers are precisely similar to those of the Lauffen-Frankfort plant. The generators deliver 300 h. p. at 50 volts and $3 \times 1{,}400$ amperes; they have 32 poles. The transforming ratio of the primary and secondary 200 kilowatt converters is 1 : 154.6.

The line consists of four wires of four millimetres diameter, one of them constituting the reserve. The average space between these wires is 17.7 inches, and the distance from the ground is about 25 feet. The same poles carry two telephone wires a little over three feet below the mains. The length of line is 14.28 miles, and the number of wooden poles 232.

In order to determine the effect of the static charge

LAUFFEN—FRANKFORT POWER TRANSMISSION.—RESULTS OF OCT. 14.

Time.	Energy delivered from the turbine. H.P.	Revolutions per minute of 32-pole dynamo, as read.			Average phase rate.	Potential (primary) between middle and outer lines. Volts.	Energy delivered from dynamo. H. P.	Efficiency of dynamo.	Efficiency of primary transformer.	Loss in the line. H. P.	Loss in the line. Per cent.	Energy delivered by secondary transformer. H. P.	Efficiency of the secondary transformer.	Potential (secondary) between middle and outer lines. Volts.	Efficiency of transmission in per cent. Between binding posts at dynamo and place of use of current.	Efficiency of transmission in per cent. Between turbine shaft and place of use of current.
10.45 to 10.55	151.8	150	150	149.5	40		139.1	0.916	0.955	12.8	9.6	114	0.950		81.8	75.1
11.00 " 11.10	151.7	150	148.2	151.1	39.9		139	0.916	0.961	12 5	9.4	114.2	0.950		82.0	75.3
11.35 " 11.45	194.7	151.5	150.1	150.5	40.2	53	182.2	0.935	0.961	24.4	13.9	114.2	0.957	63	79.1	74 1
12.30 " 12.40	197.4	150.5	151.1	151.5	40.3	to	184.8	0.935	0 961	25.2	14.2	145.8	0.957	to	78 8	73.9
1.30 " 1.40	117.6	150	150.4	150.1	40	56	104 9	0.892	0.946	7.5	7.6	86.2	0.940	68	82 0	73.3
1.45 " 1.55	112.7	150	149.6	149.4	39.9		100.1	0.888	0.944	6.9	7.3	82.2	0.938		81.9	72.9
2.30 " 2.40	78.2	147.8	149	150.1	39.8		66.1	0.845	0.925	3.1	5.0	53.5	0.922		80.9	68.5

upon the primary current or strength of the current of the generator, a number of series of measurements were taken.

The end, e, e, e, of the line (Fig. 1) was disconnected from the secondary transformer and the current sent into the open line when running with variable speed and constant potential, as well as when the potential varied and the speed was constant. The neutral point N of the three phases is not connected with earth. Later the line was also disconnected from the primary transformers at a, a, a, and the same measurements made.

A Siemens electrodynamometer (S D) was switched into the high potential line and another in the low po-

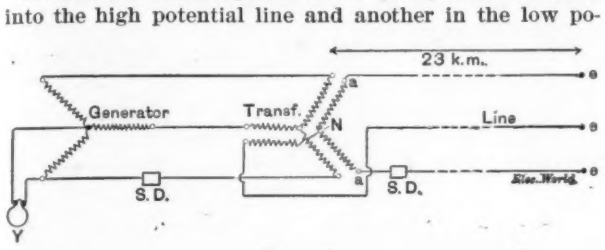


FIG. 1.

tential line; and the spring was connected up by means of two silk threads wound about the torsion head. One Weston and one Cardew voltmeter (V) were used for reading the primary potential. On the day of testing and for weeks previous the weather had been dry.

I.—TEST WITH CONSTANT SPEED AND VARIABLE POTENTIAL. LINE CONNECTED.

Revolutions.	Phases.	Voltage (primary).	Ampèrage (primary) = J		Ampèrage (secondary) = i	
185	49.3	18.0	19.1		0.164	
185	49.3	25.6	29.6		0.240	
185	49.3	29.5	34.0		0.274	
186	49.5	36.0	44.5	A	0.336	B
185	49.3	40.0	50.0		0.373	
186	49.5	50.0	62.0		0.465	
185	49.3	57.8	73.5		0.538	

II.—TEST WITH CONSTANT POTENTIAL AND VARIABLE SPEED. LINE CONNECTED.

Revolutions.	Phases.	Voltage (primary).	Ampèrage (primary) = J		Ampèrage (secondary) = i	
185	49.3	30.1	35.4		0.275	
162	43.2	30.0	27.3		0.235	
148	39.5	30.1	26.0		0.222	
135	36.0	29.8	25.3		0.214	
121	32.5	29.8	56.6	C	0.215	D
108	28.8	29.9	27.3		0.200	
92	24.2	30.2	32.0		0.155	
82	21.6	30.8	39.5		0.118	
185	49.3	40.5	55 5			
165	44.0	39.5	40.0	E		
150	40.0	40.0	36.0			
107	28.5	40.6	42.0			

III.—TEST WITH CONSTANT SPEED AND VARIABLE POTENTIAL. WITHOUT THE LINE.

Revolutions.	Phases.	Voltage (primary).	Ampèrage (primary).	
185	49.3	20.5	17.0	
183	49.3	30.8	25.1	
185	49.3	39.5	31.0	F.
186	49.5	49.6	38.0	
185	49.3	60.4	47.3	

IV.—TEST WITH CONSTANT POTENTIAL AND VARIABLE SPEED. WITHOUT THE LINE.

Revolutions.	Phases.	Voltage (primary).	Ampèrage (primary).	
185	49.3	30.8	26.0	
163	43.5	29.9	27.3	
141	37.5	30.4	30.6	
125	33.3	30.4	33.6	G.
112	29.5	30.5	38	
80	27.4	30.9	55	
185	49.3	39.5	25	
156	41.6	40.5	33	H.
86	22.9	39	57	

In Figs. 2, 3 and 4 the results above obtained are shown graphically, and the curves are lettered the same as their respective columns of figures.

From Fig. 2 it is evident that the strength of the primary current (A and F), with as well as without the line, is directly proportional to the primary potential; likewise the secondary current (B). In Figs. 3 and 4 this remarkable phenomenon becomes apparent, that the curves G and H, representing the dependence of the exciting transformer current in the phase rate, intersect the curves C and E, which represent the primary

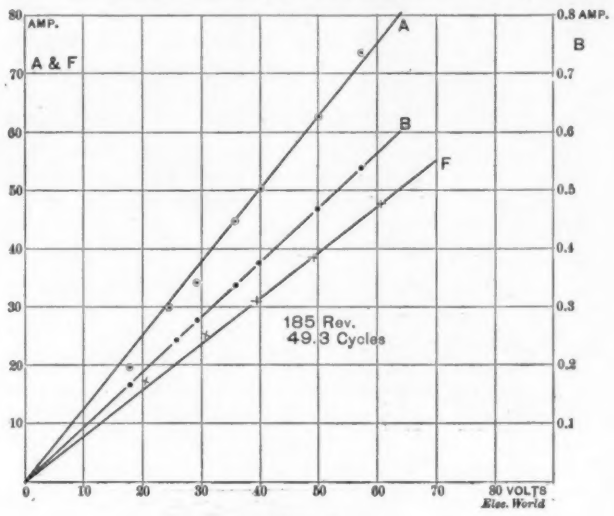


FIG. 2.

current when the line is connected. Before the point of intersection—that is, with lower phase rate—the current in the primary is diminished by the influence of the static charge of the line.

This phenomenon can be explained as follows:

If E_1, J_1, indicate the amplitudes of the primary E. M. F. relative to the primary current, then the energy used in the primary circuit is

$$P = \frac{1}{2} E_1 J_1 \cos \varphi,$$

or, for the same value of P, J_1 diminishes as the angle of the phase shifting, φ. But, in the "Elektrotechnische Zeitschrift," No. 6, 1893, Desire Korda has proved analytically that a condenser cut in on a secondary circuit retards and under certain conditions annuls the shifting of phase in the primary circuit, whose angle = φ. If C = capacity in microfarads, L_2 the inductance of the secondary circuit and in the phase rate, then, according to D. Korda, the phase shifting is a minimum in the vicinity of the value

$$C = \frac{10^6}{4\pi^2 . u^2 . L_2};$$

or for

$$n = \frac{10^6}{2\pi \sqrt{C . L_2}}.$$

The energy used in the primary circuit is, however, not constant, for the strength of the inducing current increases rapidly with diminishing phase rate and constant potential (curves G and H). The curves C and F are therefore a function of the inducing current strength and the reaction of the static charge of the line. At the intersection of C and G, also E and H, the static charge of the line has no effect on the strength of the primary current, and it will only influence the shifting of phase between E_1 and J_1.

In order to make an exact investigation of the value of C possible, a direct measuring of the secondary potential E_2 (relative to the earth) would be necessary.

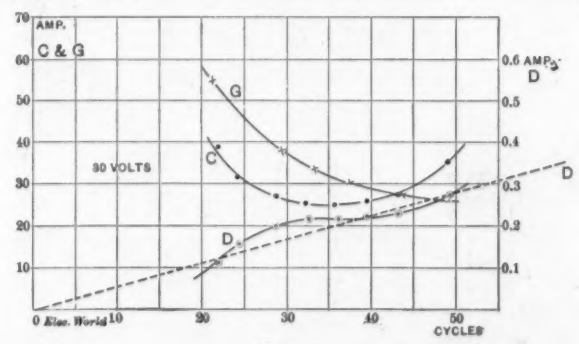


FIG. 3.

However, E_2 can be approximately determined from E_1 and the transforming ratio of the converters.

It is, then,

$$C = \frac{J_2 . 10^6}{2\pi . n . E_2}.$$

The values from the curve B give

C = 0.194 microfarad

or C = 0.0084 " per km.

Taking the same capacity per km. for the Lauffen-Frankfort line, the total capacity will be:

C = 175 × 0.0084 = 1.47 microfarad.

Futhermore E_2 = 55 × 154.6 and the current due to static charge J_2 = 3.15 amperes, at 40 phases. These results are not directly applicable to the plant when running, for then the ends of the line are connected together by means of the coils of the secondary converter.

In our case the condenser is run in in series on the secondary circuit, but during the running it is connected in parallel thereto.

In the Frankfort line it appears that, for instance, the current due to the static charge is very large in proportion to the useful current; but during the running of the plant the former and the useful current will combine to form a current of resultant strength. The effect of the static charge of the line will be dependent upon the amount of resistance and the self-induction, as well as the phase frequency.

If, for instance, the secondary circuit has considerable self-induction, then, owing to the static charge of the line, the shifting of phase may be decreased in the secondary circuit, and consequently for a given energy and given potential the secondary current may be diminished.

If a rise in potential takes place, as conclusively proved to occur on the Ferranti cables in London and in Frankfort, it indicates that the influence of the static charge exceeds the self-induction, and that the current is ahead of the E. M. F.; then the self-induction causes a rise in the resultant secondary potential. It is apparent that it would be possible, by means of a suitable amount of self-induction or proper phase frequency, to balance the effect of the static charge and the self-induction; the shifting of phase would then be zero, and the simple Ohm's law would then be applicable to the circuit.

These considerations and test results, so far obtained, tend to show that the static charge of a line for power transmission over large distances, with the customary phase rate, forms no drawback.

The curve D takes a peculiar course; after 0.3 we should obtain the straight line 0 D_1. But through the influence of the static charge and the self-induction of the line, the transforming ratio of the converters is altered by the variation of the phase rate, and this is probably the cause of the deviation from the straight line.

A Spanish Water Power Plant.

Within a short time the two small Spanish cities of Elgaibar and Eibar, situated in the province of Biscay, will be furnished with electricity for lighting and power

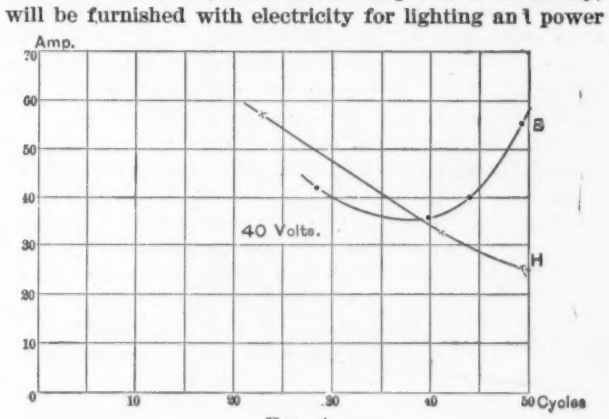


FIG. 4.

transmission. It is intended to derive the necessary driving power from the water of the Deva River. By means of a newly erected viaduct a useful fall of 25.5 feet is obtained, from which it is designed to get 300 h. p. A Hercules turbine from the firm of Singrun Brothers, of Epinal, built to furnish 130 h. p. at 200 revolutions per minute, will shortly be erected and used to drive directly an 80,000-watt rotary current machine built by Siemens & Halske, of Berlin. The exciting machine will also be directly coupled to the vertical turbine shaft.

The current generated by the dynamo has a tension of 120 volts, which is increased by rotary current transformers to 5,000 volts.

Naked long-distance wires supported on oil insulators serve to transmit the electrical energy to the two little cities, distant respectively 1 and 2.8 miles, where the current, by means of a series of secondary transformers, is brought down to the operating potential of 120 volts, and fed to the distributing network.

In the smaller settlement, Elgaibar, electric lighting is principally considered, and there they will put up 60 incandescent lamps for street lighting and about 140 for private use; while in the industrial town of Eibar the demand is principally for electricity for motive power.

Applications have there been made for the use of electric power by numerous locksmithies and small arms factories, and orders have been given Siemens & Halske for a considerable number of electric motors ranging from 1 to 25 h. p. As in addition 120 incandescent lamps for street purposes and about 400 for private lighting are to be installed, it is to be expected that the completion of the entire central station will very shortly be necessary.

The whole project is a private undertaking of the owner of the water power, and will be carried out on his account by Mr. Ermmano Schilling, of Madrid, the general agent in Spain for Siemens & Halske, from plans made by the same firm and with their machinery and apparatus.

Electricity at the World's Fair.

THE GREAT WESTINGHOUSE SIGN.

The south wall of the Electricity Building above the gallery floor, which has, until recently, been bare, and which it seems, as a space for exhibits, has gone begging, has at last been appropriated by the Westinghouse Electric and Manufacturing Company for a display of lighting effects scarcely equaled in brilliancy by any of the other brilliant electrical displays in the building. In fact, except from the space immediately beneath the south gallery, it now forms, when illuminated, the most conspicuous feature in the Electricity Building. On a background of terra cotta there has been outlined, in incandescent lamps, first a bust of Columbus in more than heroic size. Underneath is his name in large letters of fire, and to the left the date 1492 and to the right 1892. On either side is a fanciful scroll of the same material, and surrounding the whole, in a semi-circle, is the name of the exhibitor, the Westinghouse Electric and Manufacturing Company.

SOUTH WALL OF ELECTRICITY BUILDING.

The lamps composing this display are distributed as follows: In one scroll there are 398 lamps and in the other 387. The bust of Columbus is outlined in 390 lamps and his name in 165. The two dates required 95 and the name of the company 650 lamps, making a total of 2,085. These are all 16-c. p. lamps, so called, and at this rating would give a total illumination equivalent to 33,360 candles. This is not the actual illumination, however, for the attempt has been made to accentuate some of the lines by introducing into the design lamps of different voltages. The current delivered to all of the lamps is at 101 volts, and the lamps in the eye, eyebrow, nose and mouth are rated at full candle power at 98 volts. The profile and part of the face and a few in the hair are of 101 volt lamps—the bulk of the hair, the bust and the feature lines of the face are 107 volt lamps. The date and the word "Columbus" are of 104 volt lamps, while the firm name is built up with 101 volt lamps—all the rest being 107 volt lamps.

The effect of this shading is particularly fine and is the only instance of the kind at the Fair.

At present the lamps employed are all white—either clear or ground glass; but it is intended to introduce colors before long. When this is done the scrolls will be blue, the sign clear glass, the face pink and the hair and bust frosted white.

Connected with the placing of this exhibit is a little story of jealousy which is no longer a secret and may as well be told now as at any time. It is not a love-story, however, nor does it involve in any way the tender passions and their supposed diversion from the interesting object. The love-sick maiden, nor exasperated swain, nor plighted troths, nor fickle lovers figure therein; but rather that sterner emotion which one of the commandments says we shall not harbor, forms the motif of the story.

Another large concern, which shall be nameless here, having secured, as it thought, all the more desirable space in the building, watched with restless envy the encroachments which its formidable rival succeeded in making upon the space immediately adjoining its own—both to the south and to the north; and its feelings were not soothed in any measure by the erection, some weeks ago, of a huge scaffolding over the south wall above the gallery floor. So quietly was the work instituted that for a time at least it was mere surmise as to what it meant, but this surmise soon ripened into a certainty, as the sign-painters blocked out the huge letters which spell the name of the dreaded rival.

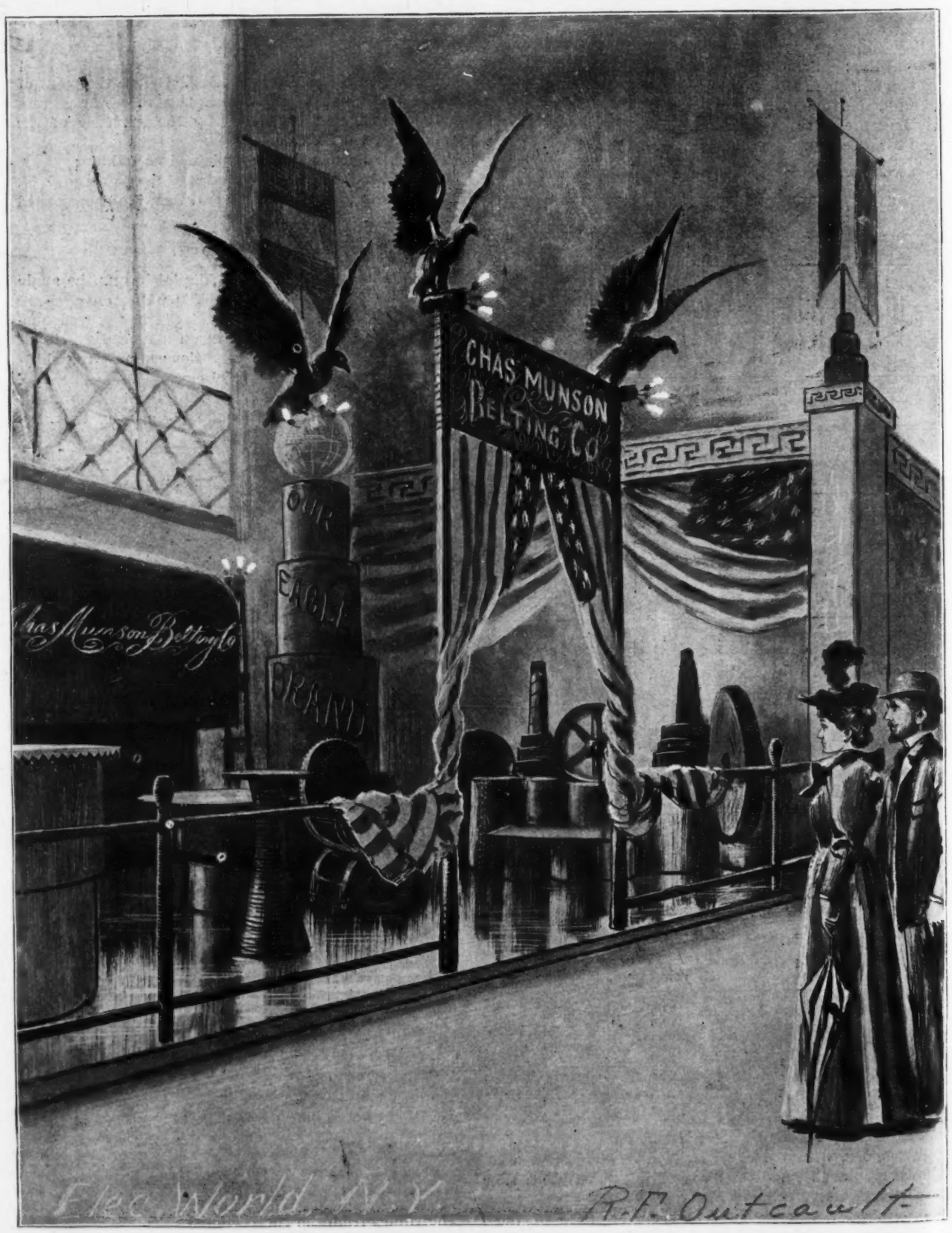
This was more than the restless firm could endure, and it proceeded to take steps to abolish the new project, and these steps took the form of a petition, which it industriously circulated among the other exhibitors, setting forth that the proposed sign was inartistic, in bad taste, and a wide departure from the general plan of the interior decorative design of the building, and asking the "powers that be" to put their foot or feet on the horrid thing. But few signatures to this document were obtained, however, as the majority of the exhibitors believed it was but a selfish fight in which they themselves had no part. They had no objection to the sign themselves, and as against the one opposed to it they rather took sides with the Westinghouse people.

The petition, however, with few signatures, went before the proper authorities, and received the attention that most of the exhibitors thought it deserved, viz., consignment to the waste basket. So the sign, or decoration, or whatever we choose to call it, was completed, and now forms one of the most brilliant features of the Electricity Building on illumination nights. Thus ended the first chapter, but this was not the end. Failing in its endeavor to suppress this latest move on the part of its rival, which it objected to on the ground of its inartistic design and incongruous appearance, the company before referred to, had recourse to something still more inartistic and incongruous, viz., a Koster & Bial fan, which it erected at the north end of its exhibit, in such a position as to effectually hide from the south half of the building the beautiful golden pavilion of the Westinghouse company, which is regarded by many as the most artistic structure in the whole building. As one views this latest creation of the company referred to, he instinctively waits for the lowering of the fan, and the leg show and variety performance which follow the lowering of its prototype on Twenty-third street, New York.

The erection of this unsightly thing, redolent of the cork room, and devoid of apparent purpose, other than revenge, has caused more quiet remark of an unfavorable character among the exhibitors at large in the Electricity Building than anything else since the opening of the Fair, and lost those responsible for it more friends than they could make in a long history of magnanimous conduct. The company referred to has not only erected a most unsightly piece of cheap scene painter's art, but has obscured a really artistic and beautiful design of a rival. It has at the same time almost equally marred the appearance of its own grand display, and the enchanting vista down the nave of the building. It would seem that the exhibitor's own good taste should cause its immediate removal, but, if not, that the authorities should step in in the interest of art and order it down at once.

A LARGE DISPLAY OF BELTING.

Unique among belt exhibits is that of the Charles Munson Belting Company, on the East side of the Electricity Building, where this usually homely but exceedingly useful material is artistically displayed. Mr. H. B. Morgan, who designed this display, has combined the materials at hand in a novel manner, showing other uses for the leather belt than that with which it is commonly associated. For instance, the space allotted to this company is inclosed by a railing, the posts and rails of which are made of leather rings, cut from belting, tightly cemented



AN INTERESTING EXHIBIT OF BELTING.

together. The floor of the space is covered with a rug of leather, in imitation of a wooden inlaid floor, but the whole is of leather of different shades, cut into geometrical figures and arranged in fantastic and pleasing designs. Some 7,000 pieces of leather are employed in this floor, and it is a very artistic and meritorious piece of work. The main entrance is outlined by a doorway of leather, across the top of which is the sign "Charles Munson Belting Company" sawed out of a piece of 24-inch double belting. This is really a fine piece of scroll work, and, being in this unusual material, is wortny of more than passing notice.

The doorway, below, is draped in American flags, tied back with leather tassels and cords, and, above, ornamented with two large American eagles, and clusters of incandescent lamps.

Around the sides of the inclosure are shown the stock in the rough state, just as it comes from the factory, marked out just as used in their Eagle brand of belting.

In the centre of the space in the rear is displayed the largest sample manufactured of the finished product, viz., an 84-inch longitudinal lap belt. This is a fine specimen of the beltmaker's art, but its beauty is enhanced by the company's name in burnished script letters in brass extending across its width.

The next thing that attracts one's attention is the furniture which is provided. This also is of leather belting and consists of the following pieces: In the middle is an atractive centre-table consisting of a roll of 24-inch belting surrounded by a much larger one of seven-inch belting, the whole provided with a leather top cut from two 36-inch centres. This, in its polished surface, makes a close approximation to mahogany, and is inlaid with a star of russet leather which might be mistaken for a rich piece of antique maple. On either side of this centre-table is a unique arm chair, skillfully constructed from the products of their shops. Just north of the entrance is a leather card table, the base of which is of thick leather discs and the pedestal of twist belting. The top, like that of the centre-table, is a large leathern disc 20 inches in diameter, and this is ornamented around its periphery with festoons of leather strings caught up with leather tassels.

In the northwest corner is a spuare-topped stand made of coils of 18 and 24-inch belting, and upon this rests a large book in which visitors are requested to register their names.

To the east is a cubical leathern box made of 20 odd pieces of leather resting upon a roll of 18-inch belting. In this is stored a plentiful supply of leather souvenir medals, samples of which are given to those desiring them.

On the south side of the space is an attractive looking settee, made of leather, of course. This is built up of two rolls of 30 inch, 12 rolls of 16-inch, two rolls of 4-inch and two rolls of 3-inch belting, the seat being formed of a single piece of 16-inch belting.

In the southeast corner is the most prominent feature of the display, consisting of a pyramid of leather belting surmounted by a globe and an American eagle, the whole illuminated with vari-colored incandescent lamps. There are three rolls of belting in the pyramid, that at the bottom being of 48-inch and that at the top of 24-inch belting and the one in the centre of 36-inch. On the surface of these rolls are described in fine twisted belting, in letters, in script, the words "Our Eagle Brand."

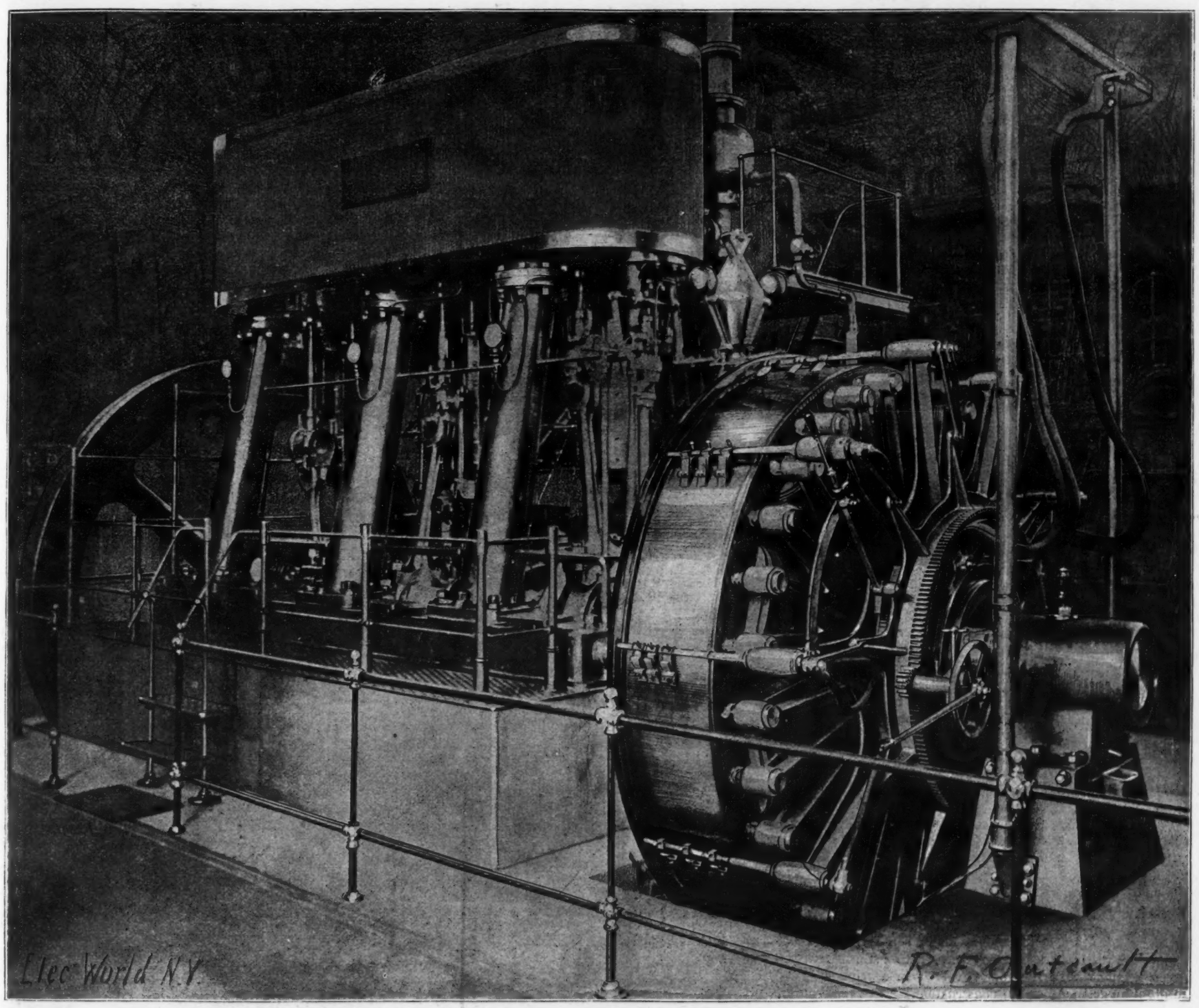
We congratulate this firm and Mr. Morgan, the designer, for the originality and attractiveness of the display they have made.

THE SIEMENS & HALSKE GENERATOR IN MACHINERY HALL.

One of the liveliest anticipations of American electricians for the World's Fair was the prospect of seeing side by side with those of American manufacture the electrical generators of European countries. It was hoped and expected that the leading foreign firms would be generously represented at Chicago by types of their machines in actual operation so that a comparison might be made with our own, as to their adaptability to existing needs. As climatic and other conditions give rise to distinct flora and fauna adapted to their surroundings, so do we find the needs and conditions of peoples giving rise to different types of manufactures which more nearly fulfill their peculiar wants. It is not often that any one of these types possesses all of the cardinal virtues, but more frequently does it happen that each possesses some one peculiar merit upon which more than anything else its survival has depended. It is one of the most important offices of such expositions as this to bring these various types together so that the strong points of each may be emphasized by comparison. Not infrequently has it happened that a new type has thus been given birth to possessing more features of general desirability than any of those from which it has sprung, and in so far as this has been the case such an exhibition has fulfilled its highest mission.

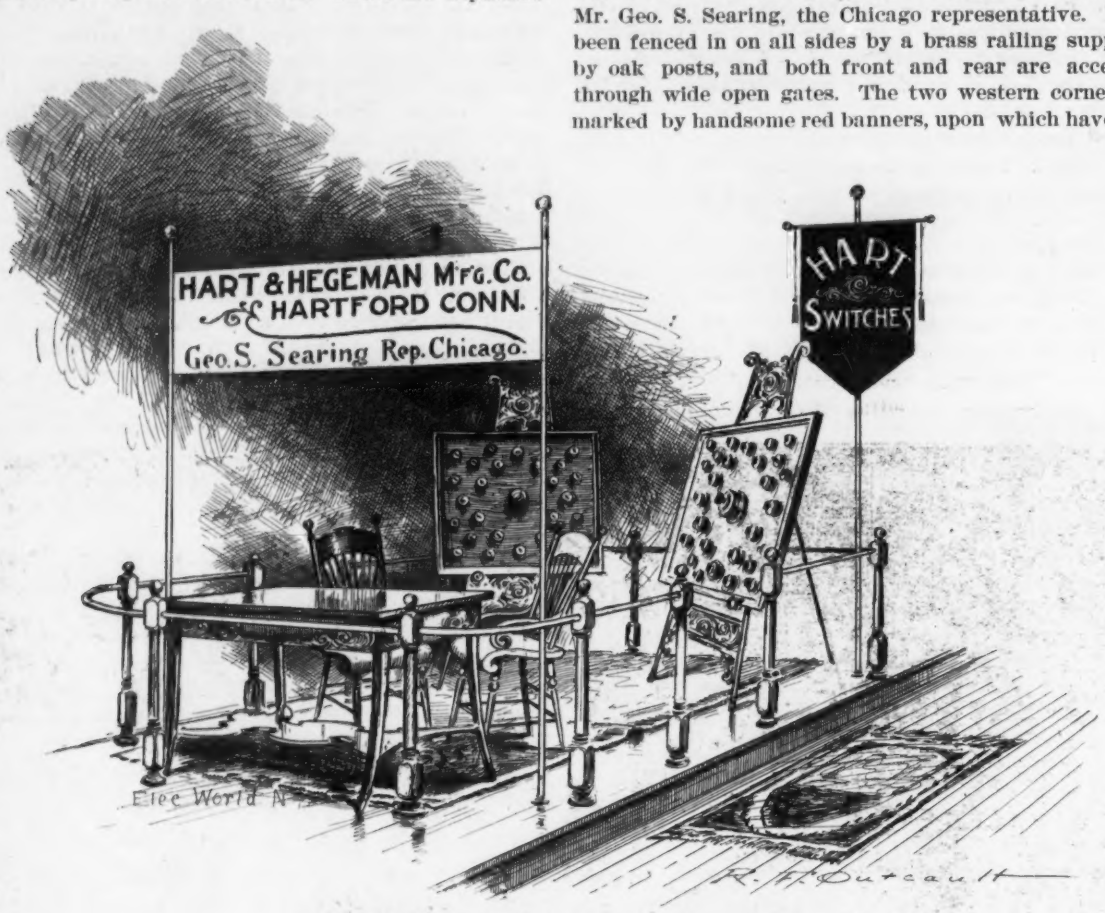
Much was to be expected in this direction in the friendly competition that was looked for between the utilitarian American generator and the more highly finished and more carefully made machines from abroad, and it has therefore been a source of serious regret that the Germans and French and English manufacturers have made such a meagre showing as they have. As a matter of fact the number of foreign exhibits of electrical machinery in motion to be found at the World's Fair may be counted on the fingers with some fingers to spare, but those that are shown may be considered as types, so far as distinct types have been evolved, of electrical design abroad.

The great house of Siemens & Halske has but a single exhibit of the kind we have mentioned, and this is the subject of the accompanying sketch. As will be seen from the cut this is of the multipolar direct connected type, which we believe the Germans were the first to more generally adopt. So far as these features are concerned, American practice is fast following suit, but the interior poles and the adoption of the exterior cylindrical portion of the armature winding as the commutator, observed in this generator has not yet gotten a foothold on this side of the Atlantic. The machine here shown has ten interior pole pieces, and five pairs of brushes which bear on the armature. The latter consists of some 1,700 windings of squared copper bars which, as before



SIEMENS & HALSKE DIRECT-CONNECTED GENERATOR AT THE WORLD'S FAIR.

stated, forms on its exterior surface the commutator also. This method of construction has been adopted by the firm for all of its larger sizes of generators, and is thought to possess some advantages over those more common on this side of the water. The yoke of the interior magnet is a soft iron ring from which extend radially the 10 pole pieces referred to. These are expanded



A TASTEFUL COLLECTION OF SWITCHES.

at their ends so as to form a nearly continuous magnetic face with alternate sections of opposite polarity. The field-magnet structure is directly supported by the engine foundations, and the shaft of the latter passes through its centre, and on this shaft is keyed the armature spider. Exterior to the armature spider are two other frames—one that to which the ten brushes are attached, and the other the one supporting the brush-shifting apparatus. The former permits of sufficient rotation for the proper adjustment of brushes to load, and the latter provides for their simultaneous removal from or application to the armature surface. The brushes are cross-connected by means of their copper strips to appropriate rings which are concentric with the armature shaft.

The armature is built up of segments of thin sheet iron, with lapping joints, as is customary here in our larger machines, and these are tied together by transverse bolts attached to the spider. It should be mentioned here that the supporting frame is centred on a bearing permitting an axial motion by which the armature may be removed to one side of the fields for repair or inspection of any of its parts.

The internal resistance is reduced to a minimum and it is claimed that the electrical efficiency exceeds 98 per cent. The output of the machine is 1,400 amperes at 500 volts, and this is attained at 100 revolutions.

The engine, by F. Schichau, of Elbing, Prussia, is of the triple-expansion marine type, and is rated at 1,000 h. p. at 100 revolutions. It is exceedingly compact and seems light to us Americans—in fact, is much lighter than our practice would indorse at the present time. The three cylinders are 22.86, 37.4 and 57 inches in diameter. The valve control is said to be exceedingly sensitive, and is actuated by a centrifugal governor, acting through lever connections with the rotary valves, in a manner quite different from American construction.

The output of the generator is employed for two distinct purposes—arc lighting and incandescent lighting. The arc lamps are placed eight in series, and are employed almost entirely in the illumination of the Terminal Station

It has often been suggested that there was a large field for electric street railroad companies in supplying arc lighting on the lines of their roads. Four lamps in series between the outside wires of the three-wire system (220 volts) are already largely employed, but we have yet to hear of the attempt in this country to place eight constant potential arc lamps in series on a 500-volt circuit. This, however, Siemens & Halske are doing at Jackson Park, and this feature will be a most interesting one to street railway men.

For incandescent lighting the five-wire system is employed. This is also a departure from American practice and will prove no less interesting to street railway men than the eight-inch series arc lamps above referred to. These features are but mentioned at this time, a more detailed description being reserved for the future, when it is proposed to discuss them in a more technical manner with the assistance of such diagrams as may make the description more simple.

HART SWITCHES.

The Hart & Hegeman Manufacturing Company, of Hartford, Conn., have a small but tasteful exhibit of the celebrated Hart switches in the south gallery near the Edison Manufacturing Company. The space assigned to these people is rather circumscribed in extent, but it has been tastefully and attractively fitted up by Mr. Geo. S. Searing, the Chicago representative. It has been fenced in on all sides by a brass railing supported by oak posts, and both front and rear are accessible through wide open gates. The two western corners are marked by handsome red banners, upon which have been inscribed in letters of gold the legend "Hart Switches." The floor is covered with a rich Turkish rug, and in addition to the table and chairs there are three tasteful easels, draped at the top with American flags and supporting small sample boards of their manufactured articles. One of these is furnished in white and upon it are displayed a number of wall switches in various designs in bronze, steel, gold and silver plate and enamel.

Another easel supports on its front a black walnut board with the familiar Hart switch in various sizes distributed over its face in geometrical designs, and on the reverse or rear a similar board with other designs of the same manufacture. The third easel supports an ebony board and on this are displayed other wall or cabinet switches for 1, 2, 3, 4, 6 and 8 circuits. These are in mottled and antique steel bronze and form a pleasing contrast with the rich black background.

This is all there is to the exhibit, but the whole story is told, viz.: that the Hart & Hegeman Manufacturing Company manufacture a first-class article with a finish that is in keeping with the richest as well as the cheaper styles of furniture.

THE BRYANT ELECTRIC COMPANY'S EXHIBIT.

Occupying a very prominent position at the south end of the east gallery of Electricity Building is situated the Bryant Electric Company's exhibit, which consists of an attractive and tasteful arrangement of the various devices manufactured by that firm. Large sample boards with oak frames have been here erected, partially enclosing their space, and these are draped in black and decorated in fanciful figures with the polished brass and nickel and white porcelain of their switches, which form a pleasing contrast with one another, and attract the eye as their merit does the patronage of the electrical public. Messrs. Edward R. Grier and Thos. G. Grier are responsible for the attractive arrangement of the goods, which stamp them at once as men of good taste and judgment. The number and variety of pieces here shown are so great as to preclude the possibility of describing them here. To understand them thoroughly one must visit the display in person and examine them in detail. Such a visit will amply repay those interested for the time spent.

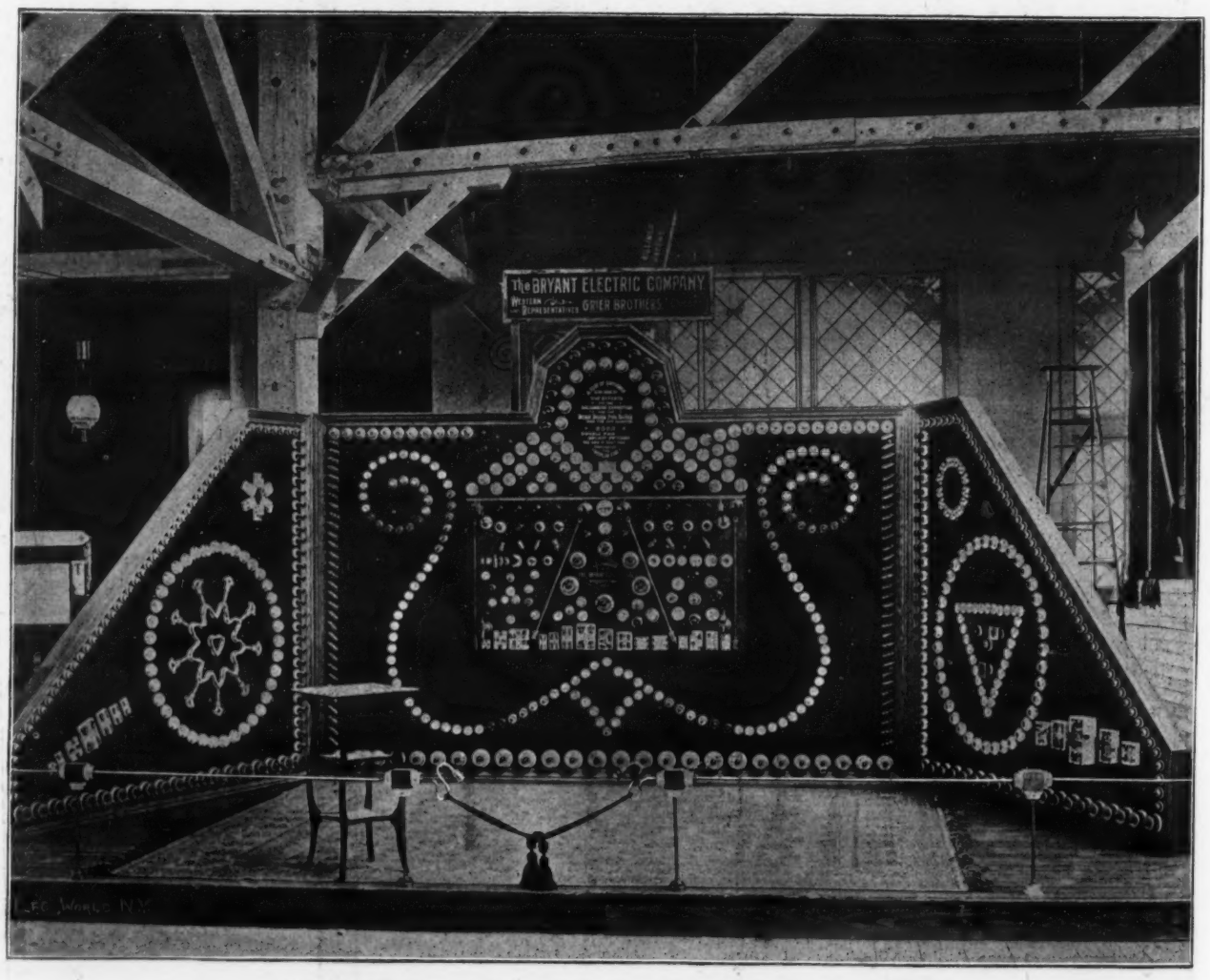
CHANGES IN THE EDISON TOWER OF LIGHT.

Many have remarked the recent improved appearance of the Edison Tower of Light. The General Electric Company, following the suggestion of The Electrical World, in a recent issue, has illuminated the capital of the tall column with a myriad of miniature lamps, which spell out on all four of its faces the words "Edison Light." This is a marked improvement on the original design and we congratulate Lieutenant Spencer upon his good judgment in making the addition. Now, either adequately illuminate the great prismatic bulb or abolish it entirely and the structure will look more as it should look and be more creditable to its designers.

THE ELECTRICITY BUILDING GALLERY EXHIBITORS' CLUB.

Ever since the opening of the World's Fair there have been no end of objections raised by exhibitors as to the manner in which they, as exhibitors, had been treated; not that particular fault was to be found with the management of the Exposition, but because of the very nature of things—the size of the buildings, lack of attractions to call the crowds into buildings, and other things. In the Electricity Building the number of complaints against the department have not been more numerous than they have in other departments, yet it has been apparent from the start that many things remained to be done to enable exhibitors who had invested large amounts of money in exhibits to obtain the best results from their displays.

The feeling in the gallery of the Electricity Building has been particularly aggressive. It must be borne in mind that to reach this gallery it is necessary to climb 60 odd steps, unless one of the two small electrical elevators is utilized. Although these elevators are doing excellent service, their capacity is of necessity very limited. Exhibitors have realized that this condition of affairs was responsible for the small attendance in the gallery, and the idea was developed of forming an organization of the gallery ex-



A VIEW OF THE BRYANT ELECTRIC COMPANY'S DISPLAY.

hibitors, the object of which was to devise ways and means of securing a better attendance in this branch of the department, as well as to promote the mutual interest of all concerned. Some days ago a few exhibitors had an informal meeting at which Mr. Thomas R. Lombard, representing the Edison phonograph interests, was elected temporary president, and Mr. M. J. Sullivan, representing The Electrical World, temporary secretary. Steps were immediately taken to interest all the gallery exhibitors, and a meeting was held Friday afternoon, July 14, in the office of Chief Barrett, at which were representatives of nearly every gallery exhibitor.

After expressions of approval had been received from a majority of people present, it was resolved to make the organization permanent under the name of "The Electricity Building Gallery Exhibitors' Club." Mr. Thomas R. Lombard was elected permanent president; Mr. C E. Lee, vice-president, and Mr. M. J. Sullivan, secretary and treasurer. A committee of five was appointed to formulate a course of action and to report at the next meeting.

Dr. Hornsby, who addressed the meeting on behalf of Chief Barrett, welcomed the movement. After expressing humiliation that such a meeting should be found necessary, he related the exact condition of affairs, showing that it was no lack of interest on their part that had left the gallery without many of the attractions and attachments that would draw larger crowds, but the lack of financial assistance on the part of the Exposition. The Council had long ago been asked to supply elevators: they at first considered the matter favorably, but when it developed that it would cost the Exposition something they decided not to co-operate with the department.

Dr. Hornsby then complained that another element of disaster to gallery attendance was that people did not appreciate the exhibits there installed; that they saw the sights downstairs and with that seemed content. He felt that the daily press of Chicago could do much toward directing attention in this direction, and that the technial press could also do much more than had been accomplished up to date. For one, he was willing to put in his own personal time writing articles that would help in directing attention to the displays in the gallery, these articles to be published in the daily papers of the city according to some plan that may be decided upon. He referred to the immense size of the Exposition, and to the well founded objections raised long ago as to the undesirability of the galleries as places to locate exhibits.

Dr. Hornsby, in referring to the action of the press, seemed to feel that the technical press had not done as much as they might to bring the gallery exhibits to notice. Replying to this, Mr. Nelson W. Perry, editor of The Electrical World, stated that, while speaking particularly for his paper, he felt he expressed the sentiments of every member of the technical press, when he said that he stood ready to do anything the Club might suggest in the way of promoting their interests, and requested them to come forward with any suggestions they might have. The house then went into committee of the whole for discussion.

A strong appeal was made by Lieut. Spencer, representing the General Electric Company and the National Carbon Company, to conciliate the Club to the American Exhibitors' Association, which, it will be remembered, is already organized to advance the interests of the American exhibitors at the Exposition. Resolutions were passed to the effect that there was nothing either in the spirit or form of the Club that could in any way antagonize the American Association; but it was the sentiment of nearly all present that the Gallery Exhibitors' Club should remain a separate organization, co-operating with the other association in every way possible. The meeting adjourned to meet Monday, July 17, at 3 o'clock.

THE ELECTRICAL WORLD'S VISITORS.

The following have registered at the Electrical World's Headquarters in the Electricity Building, World's Fair: E. S. Seixas, London, Eng; G. G. Carter, Berlin; T. G. Grier and W. P. Sullivan, Chicago; C. H. Hudson, Philadelphia, Pa.; R. W. Pope, New York; W. Greaves, M. D., Northfield, Minn.; J. W. Porter, Kansas City; E. Nashold, Denver, Colo.; E. L. Kahle, Rock Island, Ill.; Dan Joh Wadey, Helsingfors, Finland; John R. Mirkle, Allegan, Mich.; H. S. Baldwin, Jr., Washington, D. C.; H. M. Jones, Marysville, O; G. G. McDuff, Detroit, Mich.; H. P. Goodall, Chicago; A. D. McNair, Grand Crossing, Ill.; H. F. Bruce, Chicago; C. S. Donough, Myerstown, Pa.; S. Nixon, Butler, Pa.; A. M. Barron, Cleveland, O; J. R. Coffman, Detroit; J. H. McGill, Denver; J. W. Porter, Yankton, S. D.; E. R. Keever, Philadelphia; John E. Ridall, Pittsburgh; C. H. Ridall. Pittsburgh; J. E. Ridall, Jr., Pittsburgh; J. C. Ridall, Pittsburgh; Bessie Ridall, Pittsburgh; Sam. H. Ridall, Pittsburgh; Mrs. L. E. Griffin, Pittsburgh; H. Hazelton, Cleveland; Mrs. Fred. Hemp, Cleveland; C. C. Speeden, Jr., New York; E. D. Worner, Jackson, Miss.; W. A. Hopper, Detroit, Mich; H. C. Byshe, London, Eng.; F. Bennett, Ireland; T. Anizan, Paris; D. E. Gae, Liverpool; G. W. Carter, Chicago; J. H. Padgham, Allegan, Mich.; A. Akeman, Athens, Ga.; Julius Lefmann, St. Louis; Rankin Kennedy, London; W. H. Gissom, Chicago; M. B. Austin, Chicago; W. J. Scott, Wahwallopen, Pa.; W. J. Atta, New York; W. J. Hammer, New York; B. C. Kellogg, Chicago; O. M. Lacey, Hawford, Cal.; E. J. Spencer, Boston; S. H. Douglas, Chicago; J. B. Bleyer, Chicago; A. P. Eckert, New York; J. J. Plasil, Richmond, Wis.; F. Rae, Detroit; F. S. Gassaway, Chicago; H. E. Waite, M. D., New York; R. R. Alwood, Montpelier, O.; W. G. Clough, Portage, Wis.; H. L. Graus, Peoria, Ill.; E. W. McCrary, Appleton, Wis.; W. H. Benham, Jr., Cedar Rapids, Neb.; W. C. Fadrea, Cedar Rapids, Neb.; Lawrence Page, Lawrence, Kan.; C. B. Easty, Cleveland, O.; D. G. W. Williamson, Dobbs Ferry, N. Y.; W. R McLaughin, New York; A. H. England. Chicago; Chas. Akerman, Athens, Ga.; P. S. Bemis, Jr., and M. J. Buckley, Chicago; Wm. Grace, New York; H. J. Kenfield, Chicago; C. E. Stump. New York; E S. Bowker, Kokomo, Ind.; W. P. Phellon, Chicago; C. A. Noll, Chicago; J. E. Fromp, Chicago; Gleason Wood, Waltham, Mass.

Discussions of Electrical Congress Programme.

The June-July issue of the "Transactions of the American Institute of Electrical Engineers" contains a compilation of discussions, suggestions and criticisms that have appeared in the technical and scientific press upon the provisional programme of the Institute sub committee, of which the *résumé* is given below, and also some remarks of Mr. Kennelly and Prof. Nichols and papers by Prof. MacFarlane and Dr. Sahulka from the same number of the Transactions.

RÉSUMÉ OF OPINIONS AND SUGGESTIONS EXPRESSED IN REFERENCE TO THE REPORT OF THE SUB-COMMITTEE ON PROVISIONAL PROGRAMME, AND TO THE DECISIONS OF THE FORTHCOMING CONGRESS AT CHICAGO.

Opinions have been unanimous in favor of leaving unchanged the values of existing practical electrical units, as already adopted by past congresses.

It has been pointed out that the definition of the mean intensity of an alternating current adopted by the Paris Congress of 1889 is incorrect as stated, and calls for a slight amendment by way of explanatory addition.

It is generally admitted that an international unit of illumination is in practical demand. The unit proposed in the report, namely, the illumination of a bougie-decimale at the distance of a metre, has been well received, except in Germany, where a sub-standard unit of illumination based upon the Hefner-Alteneck lamp has been favored.

The definition of the concrete standards of the practical units, as recommended in the report, and taken from the Report of the British Board of Trade Committee on Electrical Standards, has met with general satisfaction. In regard to the ohm it has been suggested that the definition shall be regarded as final from a practical point of view, and that whatever slight discrepancy may be discovered in the future between this and the best known approximation to the true ohm shall not affect the practical concrete standard, whose formal specification might be worded and denoted accordingly.

The retention of the terms ampere-hour and kilowatt-hour has been universally favored.

The introduction of a practical unit of conductance has met with favor, and the name "mho" for this unit has only met with opposition in Germany on the plea of an unclassical treatment of a name held in universal respect, the name "thomson" being advocated as a substitute.

The recommendations of the report in reference to the new practical magnetic units has given rise to considerable discussion and difference of opinion. It has long been contended in English technical journals that the practical computations of electromagnetic machines based upon C. G. S. magnetic units introduce burdensome coefficients, such as 10^8, with inconvenient frequency, while, to fill the needs of a system of nomenclature, names for magnetic units in such computations have been improvised and employed provisionally. The German proposals have, however, been to retain the C. G. S. units, and without names for them. In France the same difficulty of framing a practical system of magnetic units into a thoroughly convenient and harmonious series has elicited a discussion as to whether any or all of the units recommended in the report should be adopted. A Canadian suggestion has been made to adopt the units of flux and flux density as proposed, but to make the ampère-turn the practical unit of M. M. F. and alter the unit of reluctance in the ratio of $1:4\pi$ to correspond. Aside from the difficulty in agreeing upon the values of these magnetic units, the names recommended for them in the report have been generally well received, the term "oersted" perhaps excepted.

The adoption of the term "henry" for the unit of self or mutual induction has met with general consent. Difference of opinion has, however, been manifested with regard to the name of the quantity whose unit it denotes, the term "inductance" having been employed in France to denote the product of a self-induction by an angular velocity, while in England and in America writers have been divided; some employed it in this sense, and others, perhaps a majority, with the meaning given in the report, of a coefficient of self-induction, or mutual induction simply.

The suggested definition and introduction of the term "inductivity" has been disfavored, and the definition for "impressed E. M. F." has been generally considered unnecessary.

The definition of the value of Matthiessen's standard of conductivity has met with opposition in France and Germany as being of national rather than international importance.

The definition of the north pole of a magnet has not been opposed, but it has been pointed out that in the definition recommended in the report the word "terrestrial" might replace the word "geographic," with less danger of ambiguity.

The definition of alternating current systems as simple, diphase, triphase or polyphase has been favorably considered in all but the wording of the proposal. It has been suggested, however, to consider any non-simple alternating system as a polyphase system.

The use of the term "voltage" has met with favor in England, but with disfavor in France and Germany.

The terms "transformer" and "dynamotor" in place of "convertor" and "continuous-current-transformer" have not been opposed, except as being somewhat beyond the scope of an international congress. The more universal use of the term "kilowatt" in place of the term "horse power" has only met with disapprobation in England.

In France and Germany objections were made to some of the terms suggested, on the ground that they were specifically English.

The more universal introduction of the metric system of weights and measures has met with general favor.

Strong recommendations have appeared in favor of an international system of symbols and notation for electric, magnetic and physical quantities generally, with a corresponding revision of the existing system of electrical and physical nomenclature. The system of notation advocated by M. Hospitalier, and generally recommended in the report, has not elicited adverse criticisms, except in the case of a few of the symbols suggested.

In conclusion your Committee submits the view that, considering the very debatable nature of the subjects forming its report, the variety of opinions formed in different countries and expressed under different interests, the reception of the report has been remarkably favorable and appears to have attained the desired object, namely, a concentration of general opinion toward a consensus in aid of the forthcoming electrical congress.

CARL HERING, Chairman.
A. E. KENNELLY.

DISCUSSION OF ELECTRICAL CONGRESS PROGRAMME.

Mr. A. E. Kennelly: We have difficulties in the magnetic circuit of two kinds. One kind is that we cannot use the ampère-turn directly as the practical unit of M. M. F. without a numerical coefficient. We ought to be able to use ampère-turns on dynamos as the units of magneto-motive force, if the purposes of convenience in that unit alone were considered. We cannot consider the convenience of one unit alone, because we have to consider the whole system of units, and the sub-committee of this Institute has submitted the view—one, I think, in very general commendation—that we cannot employ ampère-turns directly, but we have to employ the awkward numerical factor of $12.57\ 4\pi$ with it. There have been several schemes suggested, excellent ones in their way, for obviating this unfortunate necessity, and for giving us ampère-turns directly as the magneto-motive force and throwing this factor into some position in the system where it may, in the opinion of the parties promulgating the idea, be of less objection and disadvantage. Each of those questions must be considered impartially upon its own basis. But broadly, they all mean a departure from the existing system of practical units, the volt, ohm, ampère, etc.; and, therefore, if we are to have what may be for the magnetic circuit, what may be for dynamos and motors, a more convenient system of practical units than the one which is immediately suggested, it can only be at the expense of a departure from the old units, and that breach must necessarily be an awkward hiatus for all computations of a practical nature. The second difficulty is in the magnitude of the units. The practical system started out with a clear field before it and made the ohm a practical unit, a reasonable quantity and a very practical one, and I think it meets with universal commendation and has served its purpose remarkably well. The volt was next issued, which was another arbitrary multiple of the fundamental C. G. S. unit approximating to the E. M. F. of one Daniell cell. The volt also has served its purpose well, although the immediate combination of the volt and ohm, the ampère, at one-tenth of the C. G. S. unit of current, is a disadvantage. However, I do not think that any of us have suffered great inconvenience from the employment of the practical system at the present time. The employment of a concrete and coherent system forces upon us practical units in the magnetic circuit that are of very awkward magnitudes. The unit of flux becomes 100,000,000 C. G. S. lines, and that is a very large quantity, as we do not have dynamos with so much flux in them. Also an intensity such as the earth's field, for example, became extremely difficult to designate on the suggested practical system. However, we have to bear in mind that all amendments of the practical system involve—while they may give us a certain convenience perhaps—a departure from the existing fundamental rules that are part and parcel of the absolute system of measurement, and that for this advantage of local convenience we have to assume an expense in work of memory. The four units—gilbert, weber, oersted and gauss—have been suggested by the Committee of this Institute as those best fitted to concur with the original ampère-volt-ohm system, and it is in the hope of being able to obtain a thoroughly practical system of units that we can look for the advantages which the forthcoming Electrical Congress will have in store for us.

Prof. Nichols: May I say a word as to the standard of illumination? It would seem to me unfortunate to as-

sume that we are likely to have a standard, between now and the meeting of the Electrical Congress in Chicago, for illumination, that is worthy of the name of Davy or of the name of any one. I think the time is not probably very far distant when we shall be able to define illumination in terms of the C. G. S. system; in other words, to actually get within our grasp a candle-light equivalent which will express what we all desire, and which will be capable of interpretation in the sense that having defined it, we shall be able to make secondary standards which will produce the given amount of light, so that we may know what it is that we are measuring. That time has not yet come, but the indications are that it is not far distant. Would it not be better then, before establishing and fixing this matter, to simply regard it as tentative, to adopt temporarily whatever seems most desirable to the Congress, and to let the permanent naming of it wait until the time when we are able to define our light unit in a system which is a part of the great system which we are hoping to do something towards the completion of in Chicago this summer?

PROF. ALEXANDER MACFARLANE ON THE NOTATION PROPOSED BY M. HOSPITALIER.

I wish to make some observations on the "Table of Symbols of Physical Quantities and of Abbreviations" proposed by M. Hospitalier at the Frankfort Congress, and recently recommended for adoption by the Sub-Committee of the Institute on Programme for the Chicago Congress. My observations have reference to some features of the plan which it seems to me ought to be discussed and perhaps amended. The account of the system which I have before me is that published in the London "Electrician" forJan. 15, 1892.

The analysis upon which the system is based is thus stated: "The first and most indispensable point is to establish a clear and precise distinction between a *physical quantity*, its *magnitude* and the *unit* which serves as a common measure in a given system to all magnitudes of the same kind. A physical formula always establishes a relation between physical quantities, each physical quantity being represented by a special symbol. The magnitude of a physical quantity is represented by the ratio between a physical quantity and the physical quantity of the same kind which is taken as unity. The magnitudes of physical quantities are, therefore, essentially abstract numbers. Finally, the unit is a physical quantity of a particular size, which serves as a common measure, multiple or sub-multiple, to quantities of the same kind, which is designated by a special name, and which allows of abbreviations intended to simplify speech or writing. The symbols of physical quantities enter into physical formulæ, but units never do."

The above would be a sufficient analysis, if all physical quantities were of the non directed or scaler kind. But it is not so; there are many electrical quantities of the vector kind, not to speak of more complex kinds. Thus in Clerk Maxwell's "Electricity and Magnetism," Vol. I., p. 10, we find: "When we wish to denote a vector quantity by a single symbol, and to call attention to the fact that it is a vector, so that we must consider its direction as its magnitude, we shall denote it by a German capital letter, as $\mathfrak{A}$ $\mathfrak{B}$, etc." In the writings of Fleming, Heaviside and other electricians, such vector quantities are denoted by simple black letters, such as $\mathbf{A}$ $\mathbf{B}$, which are much easier to write and to read.

To avoid interference with such higher analysis, or to provide for it, we require more extended views of physical quantities. Physical quantities are either non-directed or directed. A non-directed quantity consists of magnitude only; a directed quantity consists of magnitude and axis. Magnitude is further analyzed into ratio and unit. In M. Hospitalier's scheme, symbols are provided for magnitudes only, none for physical quantities involving direction. Thus v denotes the magnitude of a velocity, without regard to direction; F the magnitude of a force; the German $\mathfrak{M}$ means the magnitude of the magnetic moment, not the magnetic moment itself; $\mathfrak{B}$ the magnitude of the magnetic induction, not the magnetic induction itself. This defect may be removed by retaining the black letters $\mathbf{M}$ and $\mathbf{A}$ to denote the magnetic moment and magnetic induction, while corresponding italic letters M and A denote the respective magnitude.

Another feature of the plan, which appears of doubtful utility to one who has studied the higher analysis, consists in denoting by the same symbol all physical quantities which have the same dimensions. For instance, W, the symbol for work, is also made the symbol for moment of a force, because the dimensions of both are $L^2 M T^{-2}$. But, though their dimensions are the same, these quantities are very different in nature; work is a non-directed quantity, while moment of a force is a directed quantity. In work the two lengths have a common direction, while in moment of a force they are transverse to one another. To give the same symbol to two quantities so different in their nature is not sanctioned by established notation, and it proceeds upon a principle which is novel and not in accord with the results of the higher analysis.

In the higher analysis it is important to have not only a symbol for an angle, but also a symbol for an axis. The Frankfort Congress recommended physical constants and angles to be represented by Greek letters. An axis is also best denoted by a Greek letter. Let $\mathbf{B}$ denote a directed physical quantity; then, if the italic B denotes its magnitude and the Greek β its axis, we get a compact systematic notation which is very easily remembered.

In the plan of M. Hospitalier, centimetre per second is abbreviated by cm / s, dyne per square centimetre by dyne / cm², and centimetre per second, per second by cm / s₂. Here we have a contradiction. If dyne / cm² express a dyne per square centimetre, then by the same rule cm / s² expresses centimetre per second squared. The unit centimetre per second per second is properly abbreviated by (cm / s) / s; the idea cannot be unambiguously expressed without the use of a bracket. For example, 980 (cm / s) / s expresses the accleration of gravity, while 490 cm / s² expresses the connection between the fall and the square of the time elapsed.

The importance of the use of a bracket in expressing a derived unit in terms of the fundamental units is well shown in the case of the unit of specific resistance. In some English works such as Ayrton's "Practical Electricity," specific resistance is expressed in terms of "ohm per cubic centimetre." In a recent paper M. Hospitalier criticises this usage as follows: "For the same reason, only the units of the quantities which define that quantity should enter into the definition of a unit of measure for a given quantity. Thus, for example, the English persist in expressing specific resistance in ohm, per centimetre³, on the assumption that the specific resistance of a substance is the resistance of a cube of one centimetre cross-section between opposite faces Specific resistance cannot be measured in ohms per centimetre³; it is the product of a length and a resistance, and should be measured in centimetre-ohms.

I drew attention to this matter in a paper read before the American Association for the Advancement of Science at the Washington meeting in 1891. Specific resistance is not properly expressed in ohms per centimetre³, because *per* denotes proportionality, and the resistance is not proportional to the volume. The true unit can be expressed with the help of a bracket, thus: ohm per (centimetre per centimetre²); that is, the resistance is proportional to the length divided by the cross section. This is the direct definition of the quantity, and much more logical than the definition by means of dimensions.

In M. Hospitalier's table no names are suggested for the C. G. S. magnetic and electromagnetic units. It is to be hoped that the principle of defining them by means of their dimensions will not be adopted. Given words for the C. G. S. units of intensity of pole, current, electromotive force, and resistance, then the others can be defined by compound words which express, not the dimensions, but the relations of the units to one another. Let P denote the word chosen for C. G. S. unit of intensity of pole; X the word for C. G. S. unit of current; Y the word for the C. G. S. unit of electromotive force; Z the word for the C. G. S. unit of resistance. Then:

the unit of magnetic moment is P—centimetre.
" " intensity of magnetization, P per cubic centimetre.
" " intensity of field. dyne per P.
" " magnetic flux, dyne per P—square centimetre.
" " quantity of electricity, X—second.
" " capacity, X—second per Y.
" " specific resistance, Z X per (centimetre per square centimetre).
" " conductivity, X per Y.
" " resistance, Y per X $(=Z)$.
" " specific conductivity, centimetre per square centimetre per Z, etc.

DR. JOHN SAHULKA, AUSTRIAN DELEGATE TO THE CONGRESS, ON THE REPORT OF THE COMMITTEE ON THE PROVISIONAL PROGRAMME.

I. New Units.—1. In the calculation of magnetic circuits the field strengths which occur in practice would have to be expressed in very small decimals, and magnetic resistances in very large numbers. In order to have convenient numbers it would therefore be necessary to use the units micro-gauss and mega-oersted. This makes it desirable to retain the absolute C. G. S. system of units. The practical units, volt, ampère and ohm, were introduced only because the absolute C. G. S. units would have given inconvenient figures for the quantities occurring in practice. In magnetic circuits no reason exists for giving up the absolute system of units.

2. The introduction of a unit (the mho) for the electrical conductivity of a circuit is not a necessity, as all calculations can be made with the units ohm, ampère and volt.

II. Names for New Units—1. Should the absolute C. G. S. system of units for magnetic circuits be retained, which from recently expressed opinions seems probable, the introduction of new names would not be necessary.

2. The name "mho" for the unit of electrical conductivity was probably used by some one because it was introduced by Sir Wm. Thomson; should the new unit be introduced, it would be easy to find an appropriate name (thomson). In order to be consistent, one would then have to introduce a practical unit for magnetic conductivity (reluctivity[1]), and give it a name which is the reverse of the name oersted.

3. The name henry for the practical unit of self and mutual induction is preferred to the term quadrant, because induction coefficients are not lengths.

III. Definitions.—1. "The impressed electromotive force is the ratio of the total activity of an electrically conducting circuit to its instantaneous current strength." Formerly the term "impressed electromotive force" was understood to mean the difference of potential measured at an alternating current apparatus, or in case the whole circuit is considered, the total electromotive force. This cannot be meant by the proposed definition as the instantaneous current strength occurs in it. But if by impressed electromotive force is meant the instantaneous value of the difference of potential at the terminals or the electromotive force, there is a contradiction, for if, for instance, a circuit traversed by an alternating current contains a self-induction, then at the instant when the instantaneous value of the electromotive force is equal to zero. neither the current nor the accumulated energy in the form of a magnetic field is zero, and therefore the quotient of these values will likewise not be equal to zero; there is also a contradiction if a condenser is inserted in the circuit.

2. The universally used term, permeability, should not be replaced by the term inductivity.

3. It is very desirable that the definitions of induction resistance (inductance) and of the coefficient of self and mutual induction be adopted in accordance with the suggestions of the committee, taking into consideration the total field which is linked with a definite current strength, and not by taking into consideration the electromotive force induced during separate intervals of time. In the latter case the self-induction coefficient is a different one at every step of the magnetization, and is dependent on whether the magnetization increases or decreases. The change of value of the self-induction coefficient cannot be represented by a simple formula on account of the irregular form of the magnetization and hysteresis curve. Only such a definition of the self-induction coefficient is suitable in practice, according to which one can measure these values with the usual instruments, and according to which one can make calculations. Therefore, of the three different ways in which the self-induction coefficient can be defined, only that one is adapted to practice which takes into consideration the total field which is generated. In order not to obtain incorrect values from the proposed definition, it should be added that the same is correct only for conductors which are not branched. Mr. Blondel has called attention to this feature. When a *periodic l alternati g electromotive force*. and not a constant one, is acting in a circuit, special relations arise which make it desirable to introduce also the quantities "effective ohmic resistance" (*effective resistance*), and "effective induced resistance" (*effective inductance*); only in the case of a coil without iron, which exerts no action on any other conductor, are these quantities unnecessary. If a coil without iron is traversed by an alternating current, the difference of potential which acts can always be divided into two components, one of which overcomes the ohmic resistance, and the other the inductive resistance. The latter component precedes the former in phase by 90 degrees; the overcoming of the inductive resistance requires the production of no energy. But if the coil contains an iron core the energy of magnetization will have to be generated, besides the heating effect of the current. In this case also there are two components of the difference of potential; the one, E_1, overcomes the ohmic resistance, the other, E_2, overcomes the electromotive force induced by the periodically changing field in the coil. This component E_2 *is no longer in advance of* E_1 *by a difference in phase of* 90 *degrees but by a smaller angle* α. The inductive resistance could be determined by dividing this second component E_2 by the current strength I; from this inductive resistance one would obtain the self-induction coefficient by dividing by $2 \pi n$. The component E_2 can also be resolved again into two components, of which the one $E_2 \cos \alpha$ has the same phase as E_1, while the other $E_2 \sin \alpha$ is advanced in phase 90 degrees. The component $E_2 \cos \alpha$ involves the energy of the Foucault currents and hysteresis, the component $E_2 \sin \alpha$ involves the expenditure of no energy. The coil with an iron core acts like a coil without iron which has the ohmic resistance $(E_1 + E_2 \cos \alpha) \div I$, and the inductive resistance $(E_2 \sin \alpha) \div I$. These values are the effective ohmic resistance (effective resistance) and the effective inductive resistance (effective inductance) of a coil with an iron core. In the same way one also obtains this effective resistance for every transformer, motor, condenser, etc. For the primary circuit of a transformer these values were calculated by Maxwell in the year 1865, and were represented in the above manner. The effective resistances of an alternating current apparatus can in every case be found when the current strength, the required difference of potential, and the energy consumed, are measured. The definitions of these values are as follows:

The effective resistance of a circuit is the ratio of the absorbed power to the mean square of the current.

The effective inductance is the square root of the difference of the squares of the impedance and the effective resistance.

The effective coefficient of self-induction is the ratio of the effective inductance to $2 \pi n$.

4. The definition of reluctivity cannot be given by saying:—It is the reluctance per unit volume, as one does not obtain the total magnetic resistance by multiplying reluctivity by the volume; it would be preferable to have it read:—Reluctivity is the magnetic resistance of a portion of the material in question, having a length of one centimetre and a cross section of one centimetre₂.

5. A definition of Mattheissen's standard is superfluous, as the Congress is not concerned with researches regarding this unit.

[1] Inductivity, or magnetic permeability, is doubtless what was meant.

THE ELECTRICAL WORLD'S DIGEST OF CURRENT TECHNICAL ELECTRICAL LITERATURE.

(Compiled from the principal foreign electrical journals.)

BY CARL HERING.

ELECTRO-PHYSICS.

Dimensions of the Absolute Temperature.—In an interesting article of a theoretical and speculative nature, in "L'Ind. Elec.," June 10, Mr. Guillaume discusses a recent contribution to the French Academy by Mr. Abraham in which the latter, starting with the law of Faraday regarding electrolysis, shows that the absolute temperature has the same dimensions as electrical potential. Mr. Guillaume points out the possibility of an error in this reasoning, showing that if applied to another case it leads to results which are manifestly erroneous. He also makes some curious and interesting deductions from it; starting with the conclusions of Poincare that the polarization of electrodes diminishes as the temperature increases and is zero at the temperature of dissociation of the electrolyte, or in other words, that temperature can under certain conditions replace electromotive force—he shows that if Abraham's conclusions are correct, the electric charge of a unit of mass of a body is proportional to its specific heat; from this he deduces the law of Dulong and Petit that the product of the atomic mass of a body by its specific heat is constant. Another deduction is that thermic conductivity is homogeneous (that is, has the same dimensions) as a magnetic field. Admitting that temperature is an electromotive force. the above deduction regarding the relation of the electric charge to the specific heat becomes very important, as it shows that a body possesses a calorific capacity only by reason of the electric charge of its atoms. The reasoning in all these deductions is given in the original.

Influence Machines.—The Lond. "Electrician," June 30, describes briefly the new influence machine of Messrs. Pidgeon & Wimshurst, recently described at the Physical Society. The object was, first, to make the capacity of each sector large when being charged and small when being discharged, which is attained by arranging fixed inductors of opposite sign to the sectors near the charging point and of the same sign near the discharging point; second, to prevent leakage from one sector to the other as they enter or leave the field; third, to increase the capacity of the machine by making the sectors large and numerous; the second and third are secured by embedding the sectors in wax run in channels in the ebonite discs which form the plates of the machine, and carrying wires from each sector through the ebonite, the wire terminating in a knob, thereby enabling the sectors to be placed much nearer together; the sectors are set askew with the radius, thus entering the field gradually and keeping the difference of potential between them comparatively small. The output is hereby increased as 5.6 to 1 compared with an ordinary Wimshurst machine of the same area of plate. In the discussion Prof. Lodge described a somewhat similar machine in which the fixed inductors are carried on a third plate between the two movable ones; the sectors are quite small and are not embedded; on short circuit the current was .001 ampere.

Discharge from Points.—The "Elek. Zeitschrift," June 16, gives an abstract of Mr. Precht's paper from Wied. Ann., Vol 49, Note 5. He found that points could in general be charged to a very high potential before the electricity will begin to discharge from them; lightning-rod points begin to discharge only when the potential has reached 15,000 volts; even extremely fine points can be charged to 2,500 volts before they will discharge continuously; dust in large quantities and some gases surrounding the points make the discharge more difficult while ultra-violet light facilitates it; a bundle of points must be charged to a higher potential than a single point in order to discharge; discharge will not take place through sharp egdes, as it will always prefer the points limiting such edges; regarding the discharge of clouds by a lightning rod and the avoidance thereby of a bolt of lightning, he believes that the action of the point is negligibly small in comparison with the great rapidity of the recharging of the clouds and that in many cases the points are inactive, as, for instance, in the generation of one bolt of lightning by another.

Modification of Ohm's Law.—According to Prof. Fessenden, in the Lond. "Electrician," June 30, the effect noticed by Mr. Sanford (see Digest, May 13) of the surrounding medium on the resistance of a wire might be explained, at least as far as it relates to gases having an effect on the conductor, by the fact that a thin film of a compound of the copper and the gas reduces the cross-section quite materially. (As this does not appear to cover all the cases it can hardly be considered as more than a possible explanation for a limited number of cases.)

Liquid Oxygen.—According to the Lond. "Elec. Rev.," June 16, liquid oxygen is an excellent insulator, a 25-millimetre spark in air corresponding to only 1 millimetre in liquid oxygen; an induction coil shows this better than a Wimshurst machine; although magnetic, liquid oxygen seems to produce no disturbance in a Hughes induction balance; the magnetic moment of iron being taken as one million, that of liquid oxygen is about one thousand—that is, about one-thousandth that of iron; cotton-wool saturated with liquid oxygen was strongly attracted by a magnet, the liquid being sucked out of it; he predicts that fluorine will also have to be classed as a magnetic gas; liquid air is also highly insulating and strongly magnetic.

Thermo-Electricity—Prof. Dewar, at a recent lecture, proved the accuracy of the Thomson and Tait thermo-electric diagram, according to which the lines for platinum and copper, if continued, meet at a temperature of –95° C. and for palladium and copper at –170° C.; at these points the E. M. F's. should pass through zero and reverse; Prof. Dewar verified this by means of the very low temperatures obtained with oxygen vapor; he found the temperatures to be –100° C. and –170° C. respectively.

Attraction of Vacuum Tubes.—In addition to his recent note (see Digest last week), Sir David Salomon, in the Lond. "Electrician," June 30, states that the attractive force ceases at once on breaking the current, and that the calculation can easily be made as to the magnitude of the force; a rough test showed it to be about half an ounce.

Electro-Dynamic Screening.—The "Elek. Zeitschrift," June 16, reprints a paper by Messrs. Ebert and Weiderman (Wied. Ann., Vol. 49, note 5) giving the results of their researches in connection with the Hertz phenomena; the results are thought to be of great interest to those who experiment with the Hertz apparatus; that is, they show the great effect the surroundings have on the success of the experiments.

Reflection of Electric Waves.—In a note in the "Elek. Zeitschrift," June 16, Mr. Geitler states if an electric wave is sent through two similar parallel wires a partial reflection, combined with a certain loss of phase, will take place wherever they are not directly parallel, where the wire changes diameter, or where a condenser is placed between the wires and connecting with them.

Inversion of the Peltier Phenomenon Between Two Electrolytes.—"L'Ind. Elec.," June 10, reprints an Academy paper by Mr. Bagard in which he gives the results of researches which verify the change of sign of the Peltier effect between two electrolytes at the neutral point.

Potential Difference Between Metals and Bases.—The Lond. "Elec. Rev.," June 30, contains a note on this subject.

MAGNETISM.

Magnetic Qualities of Iron.—The Lond. "Elec. Rev.," June 30, reprints an abstract of a Royal Society paper by Prof. Ewing and Miss Klaassen; the principal object was to determine the energy lost in hysteresis between certain limits of magnetic induction; they showed that there were marked differences in different specimens, some nominally soft iron requiring two and even three times as much work to be spent in reversing its magnetism as compared with the best iron; they showed that a great permeability does not necessarily imply small hysteresis losses; Steinmetz's formula was shown to apply fairly well as an approximation within the important practical limits, but it failed for the extreme portions of the curve. In a second set of tests direct measurements were made of the heat developed in magnetic reversals; no difference could be detected in the amount of energy consumed in the core when the secondary of the transformer was closed and when it was opened. In a third set of tests the curves of magnetization were traced. Remarkable evidences of time-lag were noticed in a bar 1.9 centimetres in diameter, specially in soft iron, even when the period was three seconds; the energy spent per cycle is a maximum at a particular frequency. Another section of the paper relates to the molecular theory of magnetization describing experiments made with small pivoted magnets.

Magnetism Induced by Very Small Magnetic Forces.—Mr. Culmann, in the "Elek. Zeitschrift," June 16, discusses the statement of Mr. Roessler (see Digest, April 1 and 29), pointing out that where the latter's results differ from those of Mr. Rayleigh there is reason to believe that they are not as reliable.

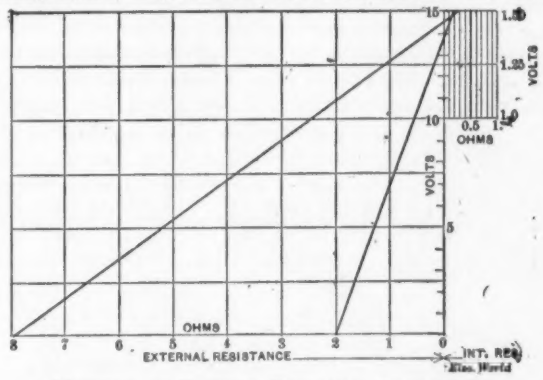
Electro Magnetic Rotation Phenomenon.—Mr. Juellig, in the "Elek. Zeitschrift," June 16, offers an explanation of the cause of rotation of a copper ball suspended near the poles of a vertical alternating magnet. No rotation will take place if the centre of the ball is in the vertical plane passing through the two axes of the U-shaped magnet, nor if it is in a plane perpendicular to this, midway between the two poles; it is greatest when placed in a horizontal plane through the ends of the poles; there is a change of direction of rotation when the ball is moved from one side to the other of the first two mentioned planes; the explanation is somewhat burdened and is not as clear and satisfactory as the one given by Thomson, who first noticed this phenomenon.

Magnetization Phenomena.—The Lond. "Elec. Rev.," June 30, calls attention to a paper in the "Phil. Mag." for June, in which Prof. Heydweiller confirms by experiments the critical point observed by Villari.

UNITS, MEASUREMENTS AND INSTRUMENTS.

Instrument for Testing Primary Batteries.—The Lond. "Electrician," June 23, describes a simple and very convenient instrument for making a quick test of the condition of a primary battery, such as the Leclanche, the dry or the closed circuit cell; it was designed by Major Holden, and exhibited at the Royal Society. The instrument is contained in a wooden case 3½ × 4½ × 2 inches, and contains a simple form of dead beat voltmeter reading from 0.5 to 1.5 volts, and a resistance coil; an illustration of the construction of the instrument is given; the principle of the voltmeter is based on the repulsion and attraction of an iron needle between the poles of an electromagnet, the arrangement being such as to produce a fairly uniform scale; a spring contact changes the resistance of the instrument from eight to two ohms; in using the instrument it is connected to the cell through the eight-ohm coil; by pressing the button the deflection obtained will give the difference of potential when working through two ohms external resistance; from these two readings, which should be made in rapid succession, the E. M. F. and internal resistance can be calculated or obtained from a table; the results for a few cells are given.

In connection with this a very convenient and ingenious system of graphical calculation, shown in the adjoining figure, is given; the two readings are laid off on



METHOD OF TESTING PRIMARY BATTERIES.

the long vertical scale and straight lines drawn through two and eight ohms respectively on the lower scale; the intersection of these two lines will, if measured by the vertical scale of volts, give the E. M. F. of the cell; the horizontal position of this point from the vertical zero line gives the internal resistance; the error due to polarization is said to become negligible when the two readings are made very quickly and in rapid succession.

Raab Meter.—Mr. Meylan, in "L'Elec.," June 17, describes this meter. It resembles in principle the Elihu Thomson and Hummel meters, differing from it, however, in the very important feature, which is considered an important improvement, in omitting the permanent magnets for the damper and utilizing instead the field of the revolving armature, the copper dampers being in that case fixed and of much larger dimensions; the advantages of this improvement are that the moving part is relieved of the weight of the copper damper, enabling the latter to be made much thicker, thereby increasing its effective resistance proportionally; also that there are then no variations due to the change of the permanent magnets. The armature is composed of seven flat coils, secured to a thin flat horizontal disc of mica stiffened with aluminium arms, the coils being connected to the usual commutator; there are two stationary field magnet coils diametrically opposite to each other and below the armature; the copper dampers are thick discs placed immediately above and below the armature. An objection is that the field is quite weak, being, it is supposed by that writer, about 100 C. G. S. units, while that in the Thomson meter is between 700 and 900; the friction of the apparatus is overcome by compounding the series coil with a small shunt coil in series with the armature; he shows that this meter is not a true wattmeter and he doubts the correctness of the statement that it reads accurately within one per cent. in all parts of the scale.

Electric Pyrometer.—The Lond. "Elec. Rev.," June 30, speaks of the Hartmann & Braun pyrometer as the most practical system yet devised; it consists of a platinum spiral whose temperature coefficient has been accurately determined, which is placed in the lower part of an iron tube extending some distance beyond the spiral; the ends are connected with a Wheatstone bridge, two of the three known resistances being altered until their ratio is the same as that between the pyrometer and the third resistance, from which the temperature is then calculated; a D'Arsonval galvanometer is used and the whole can be set up quickly; if there is any vibration the galvanometer is replaced by a telephone, the current being then furnished from a small induction coil.

Apparatus for Comparing Resistances.—The Lond. "Electrician" and "Elec. Rev.," June 30, give a description, accompanied by two good illustrations, of the new apparatus of Nalder for comparing resistances by the Carey Foster method.

DYNAMOS, MOTORS AND TRANSFORMERS.

Self-Induction of Alternator Armatures.—Mr. Pechelmeyer, in the "Elek. Zeitschrift," June 16, states that it is in his opinion incorrectly assumed that the self-induction coefficient of an alternator armature is the same for all positions in the field; to prove this he gives the results of a series of experiments made with a small machine, in which the self-induction coefficient of the armature was measured for six different positions in one-quarter of a revolution in a four-pole machine; it

was measured by Maxwell's bridge method; as a standard in this measurement he used the induction produced by withdrawing rapidly a magnet from an induction coil, a method of calibrating the galvanometer which he says is eminently practical and sufficiently accurate; the results are given in a table and in a curve, the latter resembling somewhat a sine curve; he gives an equation representing the law with a close approximation; in that machine the variations were eight per cent. on either side of the mean; as these variations succeed each other at double the rate of the phases of the current and voltage they must cause a deformation of the current and potential waves, or, in other words, the phase shifting between the current and the potential becomes a variable quantity. He suggests that the same tests should be made with a Ganz type of machine in which he thinks the variations will be found to be much greater; it should be remembered that in such measurements the self-induction coefficient of a circuit in the neighborhood of iron is not independent of the current strength with which the measurement is made; it is nearly constant only on the straight line portion of the magnetizing curve.

Steam Dynamos.—In the Lond. "Electrician," June 30, Messrs. Crompton & Co. give the results of a Willans-Crompton combination steam dynamo, which, although only one-half the size of the Willans-Holmes combination, shows results practically as good; the electrical h. p. was 79.98, the indicated h. p. 92.5, and the combined efficiency 86.5 per cent.

Excitation of Dynamos.—Mr. Snell, in his serial in the Lond. "Electrician," June 30, gives a good brief summary of the characteristics of the various methods of exciting dynamos, accompanied by the curves for each case.

Guelcher Dynamo.—The Lond. "Elec. Rev.," June 16, in connection with a description of a New Zealand station, illustrates a large alternator designed by Mr. Esson for 75 kilowatts at 480 revolutions; it resembles the Westinghouse type, but has a very large number of poles.

Transformer Design.—Mr. Weeks, in the Lond. "Elec. Eng.," June 16 and 23, continues his article, giving considerable data, accompanied by illustrations of several types of transformers and discussing their features; the article is of a thoroughly practical nature and appears to be well written.

Earthing Device for Transformers.—According to the Lond. "Electrician," June 30, the English Board of Trade has authorized the use of the Cardew earthing device, provided quick-acting fuses are inserted on the high pressure circuits, and that when the current may exceed 30 amperes on that circuit at least two such devices shall be used.

Electric Crane for Loading Vessels.—Lond. "Industries," June 23, gives a description, accompanied by an external view, of a new electric crane as worked at Southampton, modeled somewhat after those used in Hamburg; the maximum capacity is three tons; the hoisting motor takes 225 amperes and 200 volts at 600 revolutions, and is running continuously, driving the drum by means of a worm wheel run in oil.

Tools Driven by Motors.—Lond. "Electricity," June 16, 23 and 30, reprints a translation of the somewhat extended paper on this subject mentioned in the Digest April 1, together with the illustrations. Quite a large number of machine tools are shown, some with the motor as a portion of the machine itself and some driven by a separate motor. The illustrations are, as a rule, very good, and the article is recommended to those specially interested in this subject.

RAILWAYS.

Accumulator Traction.—Mr. Broekman, in the Lond. "Elec. Eng.," June 30, gives some data about the accumulator line in Birmingham, from which it appears that it had been perfectly satisfactory; he is a representative of the accumulator company. The cells (Epstein) have been in continual use since August, 1892, and are still doing good service, each having completed between 4,000 and 6,000 car-miles without even a single plate having to be renewed or doctored; they have never given the slightest trouble notwithstanding that they were heavily taxed during the winter; the rate of 3 cents per car mile at which the battery company has undertaken to maintain their cells for a period of seven years and renew all parts as may in time fall below a certain capacity, is considered very advantageous by the tramway company and is remunerative to the battery company; he states that it can be shown that such a line can be worked more economically than a direct current system; the outlay for accumulators per car for 52 passengers is about $2,500; the electrical equipment for a road of six miles would cost: For the overhead system, $120,000; for the conduit system, $180,000. With the same capital 48 cars, or 72 cars respectively, could be provided with accumulators. (The number of cars for the other systems is not given.) Longer time interval between the cars is in favor of the accumulator system, as it reduces the capital expenditure; he believes the success to have been proved beyond dispute.

Electric Locomotive.—The Lond. "Elec. Rev.," June 16, states that experiments made with a three-phase motor in connection with the Heilman locomotive (see Digest, May 6) showed that this motor would not start with the load on unless the speed of the generator was lowered at the start, so that the slow revolutions of the motor approximated to the speed of the generator, the torque being great only when synchronism is attained approximately; for this reason it has been decided to abandon the three-phase system and to adopt only the continuous current motor.

Telephone and Electric Traction.—The English journals of June 30 give at considerable length the examination of experts before the Parliamentary Committee on the subject of the interference between telephone and the earthed railway currents.

INSTALLATIONS, CENTRAL STATIONS AND SYSTEMS.

Charging for Electric Supply.—Mr. Carter, in the Lond. "Electrician," June 9, discusses the various systems of charging for the current from central stations. The cost of producing the energy, he states, takes the mathematical form $C = K + k\,Q^n$, in which K represents the fixed costs, Q the output, and n an exponent which is always less than unity; if the charges were simply proportional to the output, n would be unity; in condensing stations with a largely subdivided plant, n would be nearly unity and k would be small, while in large non-condensing or triple expansion engines k would be very much larger and n would be about 0.5; assuming for simplicity's sake, that n is practically unity, the cost of supply to a consumer will become $C = K + k\,U$, in which U is the number of units supplied. He states that it is important to notice that the cost of supply does not so much depend on the maximum number of lamps used in the stated period as on the maximum number which might be used together with the number of units of energy actually consumed. He compares the Hopkinson or Manchester, the Brighton, the Leeds and the Metropolitan Company systems of charging, illustrating them by a curve for each system, and discussing their advantages and their defects, and giving examples; in the first two, consumers using the same amount of energy but having different numbers of lamps wired will pay exactly the same amount, even though the central station must hold itself in readiness to supply all the lamps wired for; in neither does the consumer pay anything for the privilege of being able to draw on the station for all the lamps; he puts great stress on the latter; one objection to charging for this privilege is that it discourages the wiring of occasionally unimportant lamps, as in cellars, for instance, which are used most frequently when the other lamps are not in use. He also discusses the employment of meters which register differently during different hours of the day, the objection to which he says is the uncertainty of the mechanism and the impossibility of calibrating it. The scale adopted by the Metropolitan Company is based on the total number of lamps wired, and on the quarterly consumption per lamp wired; 14.5 cents is charged up to 8 kilowatt-hours per quarter per 35 watt-lamp wired and 11 cents for each additional kilowatt-hour; this system favors the small consumer, but is not as favorable to the large consumer as some of the other systems. An objection to this is that the consumer can substitute 16-c. p. or high power lamps for the standard 8-c. p. lamp, which, however, can be checked by the addition of a maximum recording ammeter; no harm is done by this substitution as long as the current does not exceed the maximum for the 8-c. p. lamp; and should it exceed this, the charge may be based on the maximum reading, or better still as a deterrent he might be charged the full price for every unit passed through his meter. To induce consumers to fill up the day load, he suggests supplying them with a meter with two sets of counting wheels and dials, one for the day and one for the night, the change being made automatically.

The station at Norwich, England, has adopted a scale in which the energy after 8 o'clock in the evening, and a little earlier on Sunday, is charged for at half the full rate.

Fribourg Station (Switzerland) Method of Charging.—"L'Ind. Elec.," June 10, in its serial on the electric industry in Switzerland, describes this station, which, as usual in Switzerland, is run by water power. The method of charging is as follows: .05 cent per candle-hour, but the consumer is held to a minimum annual consumption of 300 hours per lamp; with a wattmeter the tariff per ampere-hour is 2 cents, with a guarantee of 40 candles per ampere when the lamps furnished by the station are used; for power the charge varies from 5 cents per h. p. hour for a 1¼-h. p. motor to .45 cent per h. p. hour for an 18-h. p. motor; Khotinsky lamps of 150 volts are used; the wiring of the buildings is done entirely by the station authorities at the cost of the consumer; a charge is made of $4 per lamp for the first two lamps and 20 cents for every additional one, as payment for the right to take current. This station combines a pumping plant for the city water supply, and in that way its load is maintained constantly at its maximum throughout the whole day.

Coire Central Station.—"L'Ind. Elec.," June 25, gives a description of this station, which is run by water power, and in which high tension alternating currents of 2,000 volts are used, the alternators being run in parallel; a number of small motors from 1 to 9 h. p. and a large one of 100 h. p. are run from the circuits, the latter a synchronous motor, being started by a small non-synchronous motor of 9 h. p.

Toulouse Central Station.—The Lond. "Elec. Eng.," June 30, describes this station, in which water power is used; the unit is 300 h. p. and the total capacity is 12,000 lamps of 10 c. p.; a plan and elevation of the station are given.

Electric Lighting in Barcelona.—The Lond. "Electrician," June 30, gives a short description of this station, which is of a rather old and obsolete type; arc lights are run with Gramme machines, several machines being placed in series; the system is not a satisfactory one, and therefore a motor commutator and transformer are being added for running the arc lamps with a rectified current from the alternators, thereby raising the efficiency from 50 to 80 per cent. and halving the cost of maintenance. (The great reduction in the cost is, of course, due to the fact that originally it was excessive; it does not necessarily follow that a rectified current system is cheaper than the usual systems.)

Isolated Plant in Paris.—"L'Ind. Elec.," June 25, contains a full description, with data and illustrations, of a large private plant in St. Denis.

WIRES, WIRING AND CONDUITS.

Wiring Rules.—The Lond. "Elec. Rev.," June 30, publishes the rules of several of the London central stations; they are too lengthy to be reprinted here and are not in a form to admit of being abstracted.

Underground and Overhead Lines.—Mr. Carter, in his serial in the Lond. "Elec. Rev.," June 30, discusses the construction of lines for arc lighting from a practical standpoint, describing, among other things, the making of joints, the calculation and erection of poles, etc.

Pliers for Splicing Bronze Wire.—The "Elek. Zeitschrift," June 16, describes and illustrates a pair of pliers for making a twist joint or a loop in hard-drawn wire circuits.

TELEGRAPHY, TELEPHONY AND SIGNALS.

Long Distance Telephony.—Prof. Perry, before the Lond. Physical Society, read a paper on this subject, in which he treats the subject mathematically, assuming that the shrillest and gravest notes of the human voice have a frequency of about 950 and 95 respectively; the results are given in tables, from which it appears that, if there is no self-induction, an increase in the leakage increases the distance to which one can telephone; if there is no leakage, increasing the self-induction increases the distance; when neither is too great, increasing either increases the distance; for particular values the distances become very large. A short note will be found in the Lond. "Electrician," June 30.

ELECTRO-CHEMISTRY.

Nature of Depolarizers.—The Lond. "Electrician," June 30, reprints a Chemical Society paper by Prof. Armstrong on this subject; he calls attention to the fact that the depolarizing effect is often attributed to one substance, while he is of the opinion that it is due to another; to arrive at the nature of depolarizing agents he states that it would appear to be necessary to take into account many circumstances to which heretofore but little attention has been paid.

Conditions Determinative of Chemical Change.—The Lond. "Electrician," June 30, reprints a Chemical Society paper by Prof. Armstrong in which he gives additional argument in support of his theory that all chemical action was in the nature of a reversed electrolysis; no chemical action can in that case take place except in the presence of an electrolyte; water is not considered as an electrolyte, but it readily forms one in combination with other materials. The article is of a theoretical nature.

Evolution of Gas in Charging Accumulators.—In a somewhat lengthy article by Mr. Brueggemann, in the "Elek. Zeitschrift," June 16, he gives the results of very elaborate experiments in which the evolution of gas from an accumulator, and its composition, were carefully measured. He finds that the mixture of the oxygen and hydrogen is not always in the ratio of 1 to 2; one of his conclusions is that the charging had better be stopped before the maximum voltage is reached; that is, at the beginning of the sharp bend of the curve (a conclusion which could be arrived at without such long, tedious tests); before that point the energy lost in gas evolution is very small, while after that it becomes very great. With the intention of showing the local action, he measures the gas evolution of a cell while at rest, after a charge, for a period of about 8 days, the results of which are given graphically; the evolution of gas is at first very rapid, then changes its rate rapidly, after which it proceeds at a gradually decreasing rate. He concludes that it is very important to have the sulphuric acid and water in the accumulator as pure as possible, as the slightest impurity has a great effect on the efficiency; if such precautions are taken, a very high efficiency can be obtained.

Accumulator Tests.—Prof. Weber, of Zurich, recently made a report on storage batteries in use in a private installation, and finds that the ampere-hour efficiency was 96.5 per cent. and the watt efficiency 82.4 per cent.; he furthermore states that in accordance with his extensive experience well constructed, carefully handled and continually active accumulator batteries yield on discharge 93 to 95 and 97 per cent. in ampere hours and 80 to 82 and 84 per cent. in watt-hours.

Primary Battery.—The "Elek. Anzeiger," June 11, describes the new primary battery of Mr. Pollak, which is of the usual bichromate type, the novelty consisting in the arrangements for adding fresh liquids continuously to all the cells from common tanks; also in some of the

internal arrangements of the battery. The battery is intended for charging a set of accumulators for lighting and other purposes. The article is accompanied by a number of illustrations. The detail of the apparatus for adding fresh liquid is shown in the issue of June 22; it consists essentially of a triangular trough, which is tilted periodically and which has as many openings as there are cells, each cell, therefore, getting its proper amount; the liquid is led from the individual tanks below this trough through tubes to each of the cells; care must, of course, be taken to prevent the liquid from electrically connecting the cells with each other, which would short-circuit the middle cells. The cost of operation for supplying 20 lamp-hours per day, the lamps having 10 c. p., are as follows: Amortization and interest at 15 per cent. of the first cost of $125 (including eight accumulators of 60 a. h.) = $18.75 per year, or per lamp-hour of 10 c. p. about .25 cent; 38 grams zinc, .65 cent; 55 grams bichromate of sodium, 1.38 cents; 125 grams sulphuric acid of 60°, .37 cent, making a total of about 2.67 cents per lamp hour of 10 c. p.

Electric Carburation of Iron.—The Lond. "Electrician," June 30, in a note describes a process devised by Mr. Garnier, recently described at the French Academy of Sciences, by which iron is carbureted electrically, replacing the long and expensive process at present used for case-hardening and for the production of blister steel from puddled bar, the latter process requiring at present from 10 to 15 days. He increases the activity of the ordinary process of cementation by employing the electrolytic action of a current, using an anode of carbon and cathode of the iron to be carbureted, the whole being maintained at furnace temperature; in an experiment a rod of carbon and a bar of mild steel were placed end to end in a tube of refractory material placed in a furnace, a current of 55 amperes at 7 volts was passed from the carbon rod to the iron bar for three hours and the iron afterward plunged into cold water; the end of the bar scratched glass very strongly and the cementation had taken place to a depth of 10 millimetres. The new process affords an immense saving of time, thus increasing the annual output of large furnaces and reducing the cost of plant and stock. The "Electrician" editorially suggests that if it is possible to thus impregnate the iron with carbon it may not be impossible to extract it, or, in other words, produce malleable cast iron by a surface decarburation with the aid of electrolysis.

Moissan Furnace.—In more recent experiments with his furnace, Mr. Moissan has succeeded in volatilizing silica and zirconia. Metallic zirconium was produced, but it contained a small quantity of oxide, or when larger quantities of carbon were used it was found to contain carbon combined in the form of a carbide.

Fever Recorder.—According to the Lond. "Elec. Rev.," June 16, a novel device has been tested in Parisian hospitals; in addition to a thermometer a "fever measurer" is placed under the armpit of the patient and is connected electrically with a recorder in the physician's room, from which he can ascertain at any moment the condition of the patient without leaving the room.

Physiological Effects of High Frequency Currents.—The Lond. "Elec. Rev.," June 30, reprints an article from the "British Medical Journal," June 24, exposing the supposed harmlessness of high frequency currents, and showing, as has been frequently pointed out, that the fallacy arises from erroneous ideas about the current strength.

Cure for Insomnia.—The "Lancet" June 10, reports the case of a successful cure of insomnia by electricity, a short account of which is given in the Lond. "Elec. Rev.," June 30.

Tests for India Rubber.—The Lond. "Elec. Eng.," June 30, gives a list of the tests which have been adopted by the Russian Navy based on the physical properties of the material.

A One-Volt Standard Cell.

Prof. H. S. Carhart, in the July number of the "American Journal of Science," describes a new one-volt calomel standard cell devised by him.

The cell is made in the same form as the Carhart-Clark standard. In the bottom of the tube is pure mercury in contact with a platinum wire; on this a paste of mercurous chloride and the zinc chloride solution, which has a density of 1.391 at 15 degrees C.; a cork diaphragm follows, holding the mercury and paste firmly in position, especially with some asbestos packing under the cork; zinc chloride is then added to the proper depth, and an amalgamated zinc rod, supported by a cork, completes the electrical combination of parts. The cell must be hermetically sealed as usual. Such a cell is perfectly portable and gives promise of long life. Its internal resistance is about 1,500 ohms, and it does not appear to suffer permanent change by heating to 50 degrees C., or even to 60 dgerees. A cell six years old is still in good condition and has apparently maintained its E. M. F.

An interesting feature of this cell is its small positive temperature coefficient, which is about + .00009 within working limits of temperature. With an E. M. F. of 1.0000 volt at 13.7 degrees C., it only rose, in an experiment, to 1.0031 at 40.7 degrees C.

The Variation of Economy of the Steam Engine Due to Variation in Load.

The following matter has been added to Prof. Carpenter's paper read at the tenth general meeting of the American Institute of Electrical Engineers, since the meeting, and is a continuation from page 405 of The Electrical World of June 3, 1893:

The results given in the paper are based on the work of the steam, as shown by the indicated horse power developed, but in many cases it is essential to know the effect on the economy caused by variation in delivered horse power.

This result could easily be obtained from the preceding table, and the frictional work for various classes of engines known, because it is a thoroughly well established fact in steam engineering that the friction of an engine remains practically constant regardless of the work (see Thurston, manual "Steam Engine," vol. i., art.132-3), and is in every case essentially the same as that shown by the indicator diagram when the engine is working without load.

To determine the amount of friction that may reasonably be expected for various classes of engines, the author has gathered the following records of actual tests. These records are not as numerous as possibly might be desired, due, no doubt, to the great difficulty of obtaining an accurate record of the friction horse-power of large engines:

TEST OF SIMPLE ENGINES.

Total i.p.h.	Friction h. p.	Fricton per cent. of rated h. p.	Size of engines.	No. revolutions.	Kind of engine.	Makers.	Test by
30	3	10	7 × 12	260	Automatic	C. U.	R. C. Car'enter,1888
36	2.6	7.2	8 × 12	220	Automatic	Lansing	" "
25	2.6	9.6	7 × 10	220	Throttling	Lansing	" "
33	1.8	5.5	7 × 7	600	Small Vertical	Lansing	" "
57	2.6	4.6	8 × 14	250	Automatic		Mi'c'ell and Ald'ich
32	2.8	8.8	6⅞ × 12	250	Strt. Line		
142	12.7	8.8	16 × 30		Porter-Allen		
84	10	11.8	12 × 11	300	Westing house		Day and Riley
115	10.6	9.2					G. A. Hirn
144.8	12.3	8.5			Corliss	Bergre-Andre	
45	6.1	13.5		350	Westing-house	Westing-house	G. H. Barrus
		Av8.9					

TEST OF COMPOUND ENGINES. CONDENSING ENGINES WITH AIR PUMP.

Total i. h.p.	Friction h. p.	Friction per cent.	Size of engine.	No. rev.	Kind of engine.	Makers.	Tested by:
117.8	15.2	12.9	22×18& 21×20	208	Automatic	Lansing	R. C. Carpenter
191.4		10.4	?	?	Woolf	Koechlin	?
174.4		10.9	?	?	Compound	Alsatian Bitschwilde	?
248.9		13.7					?
77.8	10 3	12.8					Mair
134.	14.0	10.4	18&36 by 26	36.4	High duty pump	Worthing'n	Wm. Rotch
255.5		15.1	26 & 54 by 43 33 & 66	17.6	"	"	Prof. W. C. Unwin C. B. Brush G. H. Benzenburgh
370.		8.12	49.8	12.11	"	"	

Average, 12.3 per cent. Deduct probable friction of air pump, 3 per cent., gives net friction 9.3 per cent.

TEST OF TRIPLE EXPANSION ENGINES WITH AIR PUMP.

778.7	81.7	10.5	27,46&70 by 60	16.6	Vertical pump	E. P. Allis	B.H.Fiend, Chicago
573.8	52.9	9.22	28,48&74 by 60	20.3	"	"	R. C. Carpenter, Milwaukee

Trials were made by Walther, Meniner and Ludwig to determine the friction of a compound engine run in various ways. The results bring:

Compound engine with condenser and air pump.	248.97 i. h. p., 39.48 friction h. p. Per cent. of friction, 13.7.
High-pressure cylinder with condenser and air pump.	153.1 i. h. p., 24.74 friction h. p. Per cent. of friction, 16.0.
High-pressure cylinder without condenser.	128.4 i. h. p., 17.49 friction h. p. Per cent. of friction, 12.0.

It may perhaps be unsafe to draw conclusions from such a limited number of facts, but a study of the tests cited shows at once that there is no great difference as to the amount of friction in various classes of engines, the increased range of steam pressure and the greater return in work being sufficient to make ample compensation for the extra work required to move the more complex mechanism of the compound or triple expansion engine.

The friction varies to a considerable extent in different engines; in general it is less in large than small engines.

It seems to be in every case between 5 and 9 per cent. of the rated load for non-condensing engines of 150 h. p. or over, whether simple, compound or triple, and to lie between 6 and 12 per cent. for condensing engines from 50 to 150 h. p.

The condensing engines, to which an air pump is attached, usually have 2 to 3 per cent. greater friction than those without an air pump.

The average friction may be taken for engines of 50 to 150 h. p. as 10 per cent. non-condensing, and 13 per cent. condensing, those exceeding 150 h. p. as 7½ per cent. non-condensing, and 10 per cent. condensing, with very little error.

The following special test may be of interest:

Sibley College has an experimental engine of the Corliss type, with three cylinders, respectively 9, 16 and 24 inches in diameter, and 36-inch stroke. The engine can be run triple expansion, compound or simple, as desired. The engine is provided with three brake wheels, and fitted with friction brakes of very excellent design and workmanship. The following trials show the friction of the engine when run in condition of simple, compound or triple expansion; that is, with the high-pressure, high and intermediate, or with all the cylinders. The steam pressure in each case was essentially the same, and in no case was the friction of the air pump considered.

The results are as follows:

Simple engine, high-pressure cylinder only, 100 pounds steam pressure by gauge, 21 inches vacuum.

I. H. P.	Brake H. P.	Friction H. P.
62.4	55.5	6.9
62.45	55.5	6.95
73.4	66.0	7.4
82.8	76.7	6.1
	Average	6.8

COMPOUND.—HIGH AND INTERMEDIATE CYLINDERS, GAUGE 100 POUNDS.

I. H. P.	Brake H. P.	Friction H. P.
62.7	55.4	7.3
74.1	65.8	8.3
85.0	76.0	9.0
90.7	81.2	9.5
	Average	8.2

TRIPLE EXPANSION ENGINE.

I. H. P.	Brake H. P.	Friction H. P.
63.0	48.0	15.0
82.0	65.8	16 2
91.7	76.1	15.6
107.5	89.5	18.0
102.6	84.0	18.0
124.3	107.2	17 1
130.6	113.0	18.6
	Average	16.9

During these tests the simple engine was worked very much beyond its normal capacity, the triple expansion very much below.

As proved by subsequent tests, the limit of economical loading was with the simple engine at 62.4 h. p., that of the compound at 85 h. p., and that of the triple at 145 to 150 h. p.

If the percentage of friction be reckoned on this basis, we shall have the following values of the friction: Simple engine, 10.8 per cent.; compound, 9.65 per cent.; triple expansion, 11.2 per cent.

This particular engine has been run as a compound, using high and intermediate cylinders, a great many times; it has been run as a triple expansion engine only a few times, so that the excessive friction of the low-pressure engine can be readily explained as due to that fact.

Assuming what is probably true that this friction will be reduced by wear to 15 h. p., we shall have in this case substantially uniform friction, whether the engine be operated as simple, triple or compound.

It seems quite certain that the friction of these various classes of engines, when developing the same power, is essentially constant. The following table is computed on the assumption that the friction is 10 per cent. of the rated load for non condensing engines and 12½ per cent. for condensing engines.

PROBABLE WATER CONSUMPTION, PER DELIVERED HORSE POWER, FOR VARIOUS CLASSES OF ENGINES WITH VARYING LOADS.

Class of engine.	Gauge reading.	[1] Ratio of indicated load to rated capacity.						
		⅛	¼	⅜	½	¾	1	1¼	1⅓
		Lbs. of water per delivered horse power per hour.						
Non-condensing.									
Throttling simple	80	103.	74.5	50.5	44.5	46.6	48.5		
Automatic "	80	77.0	47.5	39.6	35.6	36.6	37.8		
" "	100	70.0	43.0	35.8	32.3	33.2	34.2		
Corliss "	80	70.5	43.8	36.8	33.4	34.2	35.2		
Automatic compound	100	59.5	37.7	31.8	28.8	29.4	30.1		
" "	125	52.7	33.3	28.1	25.6	26.1	26.7		
Condensing.									
Corliss simple	80	73.4	38.3	30.1	26.3	27.4	28.5		
Automatic compound	00	58.4	31.0	24.8	21.7	22.5	22.2		
" "	125	53.4	28.5	22.7	20.0	20.7	21.4		
Corliss "	100	52.6	27.2	22.6	20.0	20.6	21.2		
" "	125	47.4	25.6	19.9	18.3	18.8	19.3		
Triple expansion	125	41.4	22.8	18.6	16.6	16.9	17.3		
" "	150	39.2	21.6	17.5	15.7	16.0	16.5		

Friction load. D. h. p. = 0. Less than friction load.

[1] The numbers express the proportion of the indicated horse power developed to the rated indicated horse power.

In this comparison, the general character of the curves which represent the variation in water consumption on this basis are somewhat changed, although the curves of each class, condensing and non-condensing, occupy the same relative positions as before. These curves for the condensing engines deviate more from a right line in this than in the previous case, and all of them become vertical at a point when the friction of the engine is equal to the indicated horse power.

It is noted that the simple Corliss engine shows wide variation in economy on the basis of delivered horse power, and that its curve intersects and rises above that of the compound non-condensing engine for low loads.

The Oconto Incandescent Lamp Case.—II.

Mr. Witter commenced his argument for the defense on Wednesday afternoon, rehearsing the story of Henry Goebel as presented both at Boston and in St Louis, with additional light thrown upon it by the very important depositions of Mr. and Mrs. Opry and William A Goebel. Mr. Dyer, as in previous cases, spent considerable time in endeavoring to show how much the modern incandescent lamp depended upon the recent scientific discoveries, arguing therefrom the impossibility of any of its parts having been discovered by one working in ignorance of these. Mr. Witter, on the contrary, spent considerable time in showing that the discovery of the essential parts of the incandescent lamp did not involve or depend upon the scientific discoveries, as insisted upon by the other side, and that the lamp, instead of being a complex and mysterious aggregation of little understood parts, was, in fact, an exceedingly simple contrivance, and might have been the product of one much less skilled or versed in the arts and sciences than Henry Goebel. He also held in argument, as in the St. Louis case, that the Edison lamp was not the lamp of the patent sued upon at all, but was the product of a subsequent invention or inventions of Edison; that the lamp made by Edison according to his first patent was, by the testimony of his own witnesses and himself, totally inoperative. He then went on to show that Goebel's work was not stopped at the experimental stage or abandoned, by citing some of the uses to which the lamp had been put prior to Edison's invention. There were hosts of witnesses who testified that they saw the Goebel lamps burning on the telescope wagon from the time of his residence on Monroe street up to a late date. Many testified as to the use of the lamp to light up a clock in his bedroom. It is also in evidence that when Goebel moved from Monroe street,* his clock was taken down and moved to his next place of residence, and the lamp was reinstalled and used again for the same purpose. The testimony was very clear to the fact that one of his daughters had used a lamp over her sewing machine at No. 500½ Grand street, and that after moving to No. 468 Grand street, this lamp, or a similar one, had been again used for the same purpose. Henry Goebel, Jr., testified that he himself had removed and set up again this lamp.

There was a great body of witnesses that the light given by the Goebel lamp in these early days was good enough to read by. Many other uses of the lamp were brought out in recent depositions, and witnesses both in California and New York testified in corroboration of all of these uses. Mrs. Opry on cross-examination remembers her father working on chronometers by the light of one of these lamps. Mrs. Opry testifies on direct examination that her father used one of these lamps in some of his work, for the reason that he could put it anywhere, and while she was testifying this in New York Wm. Goebel on cross-examination in California was saying that his father used one of these lamps so that when he dropped anything on the floor he could find it. The latter also testifies that when they moved from No. 500½ to No. 468 Grand street, a notice of removal was placed in the window, and to illuminate this notice, and to attract attention, one of these lamps was used. He remembers his mother reading to his father by the lamp. As another proof of his having made these lamps, Mr. Goebel had been sent to Boston to reproduce the lamps. He reproduced a number and they did burn. It is a noteworthy fact that Edison had never been willing to produce one of his original lamps. It was not fair, therefore, to compare the Goebel lamp of the early date with the improved lamps of the present.

He then read at length Prof. Van der Weyde's affidavit, introducing his testimony by the statement that, notwithstanding this gentleman had given a second affidavit contradicting the first, the latter was nevertheless correct, and that it was very apparent that he had been tampered with by the complainants. The old gentleman was over 80 years of age, and it was admitted by the other side that Mr. Hammer had been with him for a considerable time, and that it was through him that this contradiction was obtained. This itself was a very suspicious circumstance. He said there are some 10 or 12 of the Goebel family who know intelligently about the facts, and who have testified in no mistakable way about the lamps, planers, etc., and then he went on to tell how some other witnesses had come to them, as he expressed it, "out of the clouds." Wm. A Goebel was one of these, and his testimony was not only corroborative of all that had preceded, but had adduced many new incidents and circumstances which helped to complete the chain of this extraordinary story. Van der Weyde himself had voluntarily given his evidence.

Next, he explained at length as to how lamp No. 4 was introduced and why this introduction was delayed. This was all given in the St. Louis argument.

Fitzpatrick's evidence for the complainants, in which he said that he had no recollection that he ever cast exhibit No 6, and had so informed the gentleman who had secured from him his former affidavit of Feb. 7, which had been introduced to show that the defendants had caused their witnesses to testify to things which they did not say, was met by a counter-deposition from Fitzpatrick as follows:

2 Q. "When you signed and swore to the latter affidavit, did you understand that this affidavit contradicted the statement in the earlier affidavit that you thought Goebel Exhibit No. 6 was cast by you while you were foreman for Charles E. Perley & Sons?"

A. "I didn't understand that I contradicted the first affidavit, by any means. I didn't mean to do it; I don't so understand it now."

The charge was then directly made both that the complainants had suppressed some of the testimony and that they had been endeavoring to tamper with the defendant's witnesses.

Paul H. Bate had testified for the complainants that on May 26 he had interviewed Mary Meisinger, calling her attention to her former affidavit. In the course of the interview he claims that she made the following statements:

MARY MEISINGER'S STATEMENT.

"I never saw, prior to my marriage in 1881, any electric lamps or any incandescent electric lamps which had been made or used by the said Henry Goebel, or by my husband, Adolph O. Goebel. I never saw prior to 1881 any electric lamps or any incandescent electric lamps in the store of Henry Goebel on Grand street, New York City. I remember hearing that the said Henry Goebel used to have what are called Geissler tubes, and that he made use of the same at his Grand street stores. Before marrying Adolph O Goebel, in 1881, I used to call on the daughters of Henry Goebel, but I never saw any electric lamps or any incandescent electric lamps in the store or home of the said Henry Goebel until after my marriage, in 1881, as aforesaid."

In rebuttal of this, Mary Meisinger's deposition was put in evidence, a part of which is as follows:

3 Q. "Have you read the affidavit of Paul H. Bate, given in this suit, in behalf of complainants, and verified May 27, 1893, and the paper annexed to that affidavit entitled "Mary Meisinger's statement?"

A. "Yes."

4 Q. "This affidavit states that Mr. Bate and another gentleman called upon you on Friday night, May 26, 1893, and interviewed you in reference to Mr. Goebel. Did any one call upon you at or about this time in reference to Mr. Goebel or his lamps?"

A. "No."

5 Q. (Question repeated.)

A. "No; only that gentleman I spoke to you about."

11 Q. "About two or three weeks ago, did any one call upon you at your house who stated that he was from the Edison company?"

A. "Yes."

12 Q. "Now, that is the time I mean. How many men called upon you at that time?"

A "Two."

15 Q. "What did you ask them?"

A. "I asked them where they were from, and they said 'Brooklyn,' and I said no. I asked them what office they were from. I asked them if they were from the Potter Building, and they said no, they were from Edison."

16 Q. "Mr. Bate had stated in his affidavit that you told him at that time you never saw, prior to your marriage, in 1881, any electric lamp or any incandescent electric lamp which had been made or used by Henry Goebel or by your husband, Adolph Goebel. Did you make any such statement to either of the two gentlemen at that interview?"

A. "No."

18 Q. "Mr. Bate also states in his affidavit that on this occasion you told him that you never saw any electric lamps or any incandescent electric lamps in or about the store or home of Henry Goebel until after your marriage of 1881. Did you make any such statement to either of the two gentlemen at that interview?"

A. "No."

The cross-examination of Mary Meisinger was partly as follows:

19 X. Q. "Did you have more than one interview with these gentlemen who said they came from the Edison company?"

A. "Yes, sir."

20 X. Q. "How many interviews?"

A. "Just the one."

21 X. Q. "Who were present at that interview?"

A. "My mother and myself."

25 X. Q. "What was said at this conversation? Please state as fully as you can."

A. "He told me they were not satisfied with my affidavit. That I had left out the year of my marriage, and they wanted to renew it. I thought it was kind of strange, because Lawyer Williams said my affidavit was all right; so I asked them where they were from, and they said, 'From Brooklyn.' I says then, 'I mean what office? Are you from the Potter Building?' They said, 'No; from Edison.'"

27 X. Q. "Is that all?"

A. "Yes."

28 X. Q. "Was nothing said about electric lamps?"

A. "Yes; he asked me what I knew about Mr. Goebel's lamps. I told him all we knew and had heard, and then he asked me if I ever saw the lamp in the store. I told him yes."

DEPOSITION OF SUSANNAH M'DONALD.

72 Q. "You reside with your daughter, Mrs. Mary Meisinger, do you not?"

A. "Yes, sir."

73 Q. "Mrs. Meisinger has just given her deposition. Were you in the room with her when she gave her testimony?"

A. "No; not here; at home."

74 Q. "Do you remember two men calling on your daughter, Mrs. Meisinger, about two or three weeks ago?"

A. "Yes, in May."

75. Q. "Mr. Paul H. Bate has given an affidavit in this case, verified May 27, 1893, about that call on your daughter. Have you read this affidavit and the paper annexed to it, entitled 'Mary Meisinger's Statement'?"

A. "Yes, I have read it."

76 Q. "Were you present all the time these gentlemen were calling on your daughter?"

A. "Yes."

77 Q. "In his affidavit, Mr. Bate states that your daughter, Mrs. Meisinger, told him that she never saw, prior to her marriage, in 1881, an electric lamp, or incandescent electric lamp, which had been made or used by Henry Goebel or by her husband, Adolph O. Goebel. Did Mrs. Meisinger make any such statement to these gentlemen at that time?"

A. "She couldn't."

78 Q. "You did not hear her make any such statement, did you?"

A. "No, sir."

79 Q. "Mr. Bate also states in his affidavit that Mrs. Meisinger told him that she never saw, prior to 1881, any electric lamp or any incandescent electric lamp in the store of Henry Goebel on Grand street, New York City. Did Mrs. Meisinger make any such statement to either of these two gentlemen."

A. "No, sir; she couldn't make any such statement; it would be very false; she had seen all the lamps; she is quite familiar with the lamps because she has seen them so many times."

80 Q. "Mr. Bate in his affidavit also states that your daughter told him that she never saw any electric lamp or any incandescent electric lamps in or about the store or home of Henry Goebel until after her marriage, in 1881. Did she make any such statement to these gentlemen?"

A. "No."

She was cross-examined at length by complainants' counsel, and in this reiterated her claim that her daughter had not made the statement attributed to her by Mr. Bate. In answer to the cross-question requesting her to state as much of the interview as she could remember, she says: "There is one thing; that is this: The statement says that she knew nothing about the light that was always in the window, and that book says she denies it—anything about this light that is in the window. She has seen that light as often as she has seen me."

This was the first direct blow at what were claimed as the questionable methods employed by complainants.

Mr. Wm. A. Goebel on cross-examination stated that he used at No. 500½ Grand street, or saw used, the planer (Exhibit 6) with the roller, but at that time it did not have the roller. Mr. Opry speaks of this having been used at No. 468 Grand street, where it had the roller, and states that it, the roller, was put on at his suggestion.

In regard to the lamps, Mr. Witter said that, while the complainants had introduced evidence that 1, 2, 3 and 4 were questionable, no evidence had ever been introduced that 9 was made for the purpose of this litigation. "If we can show," said he, that lamp No. 9 did exist prior to the Edison invention, it is just as good for our case as 1, 2 or 3." He then submitted evidence of the genuineness of No. 9, and stated again that there was not one word of evidence in regard to this lamp being fraudulent.

At this point Mr. A. P. Smith read the original affidavits of Henry Goebel, which have been presented in previous cases. In one of these Mr. Goebel speaks of having used plaster of paris for some of his lamps. Up to this time there had been no corroboration of this, but William A. Goebel in his deposition does corroborate this statement. William Hinton's and Phillip Ruh's affidavits were also read.

Mr. Witter then called further attention to Wm. Goebel's deposition in which he speaks of one of the planers (No. 8) having been made out of a French clock dial. This was a point that had not been brought out before, and was new to the defense as well as to the complainants. An examination of this planer, however, verified Wm. Goebel's statement. Another interesting point brought out by Wm. Goebel's deposition was the method of connecting up the lamps employed by Mr. Goebel where more than one were used. When asked what resulted if any one of a number of his father's lamps connected on the same circuit went out or did not burn—whether the others also were extinguished, he replied "No, they would burn." This shows that Mr. Goebel connected his lamps in multiple arc and not in series. So that, if this be true, Mr. Goebel also invented the multiple arc system of distribution for electric lamps as well as the lamps themselves, if such shall be proved to be the case.

Mr. Witter next took up one of the new features of the present case, in which it was claimed that lamps Nos. 1, 2, and 3 were made in 1892 by Henry Goebel, Jr., and that No. 4 was made at Goebel's house by Heger in 1882. Mr. Dyer had claimed that no lamps were known until Henry Goebel, Jr., came into Mr. Bull's office with the three lamps, as before stated, and he had no hesitation in saying that they were fraudulent. His claim had also been repeated by Messrs. Fish and Seward. Mr. Dyer had read McMahon's affidavit to prove that Goebel had no lamps at that time. Mr. Witter said that this claim of fraud was not new, but was now brought forward for the third time. The only evidence that the complainants had that was of any importance whatever on this point was that of Schumann, Heger, Cozzin and Korwan. He claimed that Hitchcock's affidavit, which was introduced to show that Judge Hallett had not considered the Kulenkamp, Goebel, Paul H. Bate, W. Laird, Goldsborough, Herman Stiefel, Wm. R. De Kraft, Siedenstock, Sminder, Todtschinder and Charles Schutz affidavits, did not say what it was claimed that it did say.

He referred again to what was said about Fitzpatrick and the false testimony that was placed in the mouth of Mary Meisinger, and paid his respects to the affidavits of Barker and Howell. Referring to Korwan's testimony, Korwan had contradicted himself, in that at one place he says there was one planer, and in another he says there was none at all. He pointed out that Heger also contradicted Korwan. He held that the new testimony is conclusive; that the planers existed before Korwan was there, and read the testimony of Perkins, Lizzie Opry, J. A. Opry, Wollstein and Wm. A. Goebel, all of them new witnesses under oath, in substantiation of this claim.

In regard to the statement that Henry Goebel, Jr., had made the lamps, he showed that the statements of Henry Goebel, Jr., Schumann, Hoffman, Cozzin and Heger disagreed among themselves as to the date, so that if one was right the others could not be, and that the inconsistency was sufficient to throw this testimony out of court. Hoffman had tried and succeeded in bribing Henry Goebel, Jr. Many other attempts to bribe defendants' witnesses were made, Lizzie Opry and J. A. Opry being cited to show the attempts at bribery, also Mr. Allen Kenyon's affidavit.

In regard to Henry Goebel, Jr.'s, statement to the defendants about having himself made the lamps Nos. 1, 2 and 3, Mr. Witter stated that the contradictions to this were specific. That Mr. Opry and Wm. A. Goebel in California both say that he had not the skill to make those lamps. It was on the basis of this statement of Henry Goebel, Jr., that Mr. Seward had stated that he believed the lamps to be fraudulent. Mr. Witter thinks their case falls right here, as it is found that the statements of Heger and Henry Goebel, Jr., the former of whom had been discredited, and the latter, it had been stated by Wm. A. Goebel, could only be believed half the time. Another way of proving that these lamps were not made in 1892, as claimed by the complainants, was by Mr. Bull's testimony. It was charged that he, Bull, had been examined by the complainants, not for the purpose of finding out the truth, but for the purpose of laying the foundation for a case against the Westinghouse company; that they did not confine themselves to the subject, but made a misuse of the privilege. It has been claimed by the complainants that Bull had not said one word about having seen the lamps; they had raised a hue and cry about not having been permitted to see Mr. Bull's daybook. It is now before the court, and the very next entry which the complainants claimed would substantiate their view of the situation was directly against them, and leaves them without foundation for their accusation.

On Friday morning Mr. Witter took up more specifically the charge of bribery against the complainants, reading the depositions of J. A. Opry and Lizzie Opry. He stated that detectives had been placed on the track of Henry Goebel, Jr., to find out the truth of his statements to them, and by this means they had proved their falsity beyond question. The court here called in question the admissibility of this testimony about Henry Goebel, Jr., looking to bribery because he was the defendants' affiant. "One's own witness," he said, "to be impeached, must have an opportunity to be heard." The defendant argued that his testimony was introduced primarily and chiefly to show why they had not called Henry Goebel, Jr., to the stand. The court decided that it would consider the testimony for this purpose, but as affecting the conduct of the complainant it could not receive it.

In conclusion Mr. Witter said that the existence and use of lamps by Henry Goebel containing all the essentials of the Edison lamp had been amply proved, and lamps Nos. 1,

* Henry Goebel arrived in New York early in 1849; lived for somewhat over a year at 271½ Monroe street, where he lived more than 22 years. From there he moved to No. 500½ Grand street, where he lived five years. In 1877 he moved to 468 Grand street, remaining there until 1890.

2, 3 and 4 alone had been questioned as having been made in 1892. These, however, have been shown by numerous evidences to have existed before. As excusing their not having called Henry Goebel, Jr., to the stand, he accused the complainants of attempts at bribery, and charged that they had cooked up evidence to suit their purpose. He characterized Dyer's argument as made up of much belief and little fact. The case of the defense was made up of fact almost wholly. Judge Hallett's decision he believed should be followed, except that the defendant should be required to give no bonds and the complainant be required to pay costs.

MR. SMITH'S ARGUMENT.

Mr. Smith followed Mr. Witter in a short argument, going to prove that the complainants' paid agents had tampered or attempted to tamper with the defendants' witnesses. He showed that the General Electric Company were kept specifically advised of the most minute movements of their witnesses, and of matters so trivial in themselves as to have rendered it impossible that they could have been advised of these through the workings of detectives employed for the purpose. There was evidently no other means of their being thus informed than through the agency of a traitor in their camp. This traitor they believe to be Henry Goebel, Jr.

The attempt of McMahon to buy a patent and to raise a mortgage belonging to the Fincks he believed was a mere blind, and that the purchase money offered in these two instances was but another name for another thing. He cites four instances brought out in cross-examination, which go to show, he thinks, that Henry Goebel, Jr., is an interested member of the Edison corporation, and that he knows everything that transpires, and conveys to the Edison corporation all of the information which they desire.

He attempted to show the complainants' knowledge of the attempt to bribe the witness Sebastiani, and to show their knowledge of the attempt to bribe Witness Finck.

In regard to the witnesses Gibby and the McMahon incident, he says: Now, who told McMahon that Gibby had been subpœnaed? Not defendants' counsel, because they did not know McMahon in this matter; not Finck, because he did not know McMahon; not Gibby because he denies it in his testimony. This leaves the Edison counsel as the only persons who had knowledge of the matter, and through them alone information must have gone to McMahon. The connection is therefore riveted to this extent by the testimony of Gibby as complainants' witness, a testimony which, under the rules of evidence, they cannot contradict, and by the nature of cross-examining counsel's questions.

1. McMahon at least considered the possibility of bribing Finck.
2. That this proposition involving the subornation of perjury was made to Finck by Gibby on the suggestion of McMahon or other persons.
3. That the Edison company were in direct communication with McMahon, and controlled him in this matter.
4. The Edison company alone could profit by the success of such an attempt at the subornation of perjury.

And summing up, he stated that they had proved by the hundred pages and more of cross examination of witness Wm. A. Goebel in California, at a distance of 3,000 miles from the rest of his family, so that there could be no opportunity for the hatching up of corroborative incidents and details, and which is so full of affirmative facts in support of all the contentions of defendant that it alone would be sufficient to stay the granting of a preliminary injunction, if not to invalidate the patent; that the old use of cement in the process of attaching the carbon to the leading-in wires long prior to the connection of the Goebel family with the American Electric Light Company is proved.

This testimony also contains a detailed story of the sending of the first of the old Goebel lamps to the American company's shop, told with an exactness of unusual incident which stamps it with the most unimpeachable character of truth and proves that such lamps were made by Goebel long prior to his connection with the American company.

The limited opportunity of the witness Bleil to see the old lamps in the Goebel store is proved in the consequent meagreness of his affidavit previously filed in the case explained.

The manufacture and use of a peculiar rubber lamp socket with switch is proved.

The use of plaster-of-paris sockets for the lamps as mentioned in the original Goebel depositions is corroborated.

An exact description of the gas blowpipe used in the manufacture of lamps, together with the changes made when work was begun for the American company, is given in such a distinct manner as renders it absolutely impossible that it should not be based upon an exact recollection of the apparatus itself.

A similarly exact description with drawings is given of the style of lamps made by the witness Heger, proving that it is improbable that Heger made lamp No. 4, as he says he did.

The exact status of the Kulenkamp affair is shown, proving, as is stated by Henry Goebel, Sr., that Kulenkamp was simply unable to secure any capital for investment, and did not fulfill his side of the contract.

That a mercury pump was used at No. 500½ Grand street—an exact sketch of the form of pump invented at a later date by Mr. Goebel, and subsequently patented, which coincides so accurately with the drawing of the patent on that pump that when the fact is taken into consideration that it was made 10 years after seeing the pump, it proves with the utmost force the accuracy of the witness' memory.

A description of the rolling of platinum wire out of a scrap of platinum plate, evidently a piece of an old crucible, corroborating Henry Goebel, Sr.'s, previous testimony of the rolling of wire in that manner.

A very clear description of a piece of apparatus which is evidently what is known in science as the Dovereiner lamp, which his father had, and which goes to prove his father's knowledge of scientific apparatus and of the phenomena of chemistry.

A description of certain toy lamps which his father had, and which have not been previously mentioned in the record, together with the convincing incidental statement that these little lamps use less battery power than the larger ones.

The making of two bamboo planers for sale, distinct from the sale of the old planers to Mr. Perkins.

A corroboration of the affidavit of various prior witnesses as to the construction of bellringing devices and burglar alarms in the Goebel house.

A corroboration and amplification of the various uses of lamps and clocks.

An elaborate description of an equally elaborate automatic mechanism made by his father, which affords additional proof of Mr. Goebel's skill and ingenuity.

An exact description of the crucibles used in carbonizing.

A clear description of lamps corresponding to lamp No. 11.

A careful description of the mode of manufacturing lamps like No. 11.

A statement that the lamps with copper wires were used "while they were good," corresponding to the known fact that lamps with copper wires were less perfect than those with platinum.

An elaborate description of the process of carbonizing.

A description of exactly what part of the fishpoles was used for making the bamboo strips, and a natural explanation of why a good many poles were used up.

A mention of the use of the current to bring the carbon to incandescence during the exhaustion by the Torricellian method, an exact anticipation of what is now done in lamp factories for the purpose of accelerating the exhaustion and driving out the occluded gases, a step that would go far toward rendering possible the production of a reasonably perfect lamp like No. 4 by this Torricellian process.

A description of the great care taken to prevent the breaking of the carbon during the operation of the Torricellian method, requiring fifteen minutes or so, which meets the criticism of his Honor Judge Colt that the carbon would be broken by the mercury in the operation of this process.

A description of attempts to carbonize thread and other materials, showing that Mr. Goebel was experimenting in all directions continually.

A description of an ingenious method of testing the vacuum of a defective lamp.

A description of the use of a lamp over a bell.

A clear setting forth of the use of three or four lamps in multiple arc, in the face of the most ingenious attempt of cross-examining counsel to entrap the witness into an admission that certain things occurred which would indicate that the lamps were connected up in series rather than in multiple arc.

An additional use of a lamp in the dining room: and lastly a full account of the batteries, including various changes which were made in them, which fully meets the prior criticisms of complainants and experts as to the silence of defendant's witnesses upon this point; and which, having been drawn forth at the end of a week's cross-examination, cannot be said to be a palpable attempt on defendants' part to meet a weakness developed by such criticism, but is a spontaneous and unpremeditated answer to it.

These points of this claim are proved in the examination, both direct and cross, of Wm. A. Goebel, the son of Henry Goebel, now living in California. This testimony covers over 100 pages of the printed record, and forms by far the most important link in the chain before the defense. In part it is as follows:

WM. A. GOEBEL'S DEPOSITION.

Q. 1. "Please state your name, age and place of residence?"

A. "My name is William A. Goebel. I am 29 years old, and my present residence is San Jose, Cal."

Q. 2. "What is your occupation?"

A. "I am an actor."

Q. 25. "When, to the best of your knowledge, did you first see an incandescent electric lamp?"

A. "You see, I don't remember when I didn't see one. I was brought up among them, and always see them as far back as I can remember."

Q. 36. "Where did you see them?"

A. "I have seen them at 500½ Grand street and at 468 Grand street."

Q. 27. "By whom were these lamps made?"

A. "By my father, Henry Goebel, Sr."

Q. 28. "Did he have any assistance in making these lamps at 500½ Grand street?"

A. "Yes, he had assistance. My brother Otto and myself, my sister Annie, and sometimes Henry, my brother."

Q. 43. "Can you give a general description of the planer which you speak of?"

A. "One planer was made out of brass, about five or six inches square and about an eighth of an inch thick; one part of the planer, what we used to call the plate, was made out of an old French clock movement plate: the top part of it, what you press down to keep the bamboo from slipping from the knife, was made out of an old telegraph operating machine."

Q. 48. "Did you ever use these planers yourself for dressing bamboo strips?"

A. "I have used the two rougher ones, but the finer planers, what we used to call the finishing planers, I never was allowed to use."

Q. 53. "I now hand you a page taken from The Electrical World, of April 22, 1893, containing cuts of planers, and ask you to state to the best of your knowledge what such cuts, or any of them, represent?"

Question objected to except as to the cut of "Goebel Exhibit No. 6."

A. "Goebel's Exhibit No. 8, which I am looking at, is the planer which I described as being made out of the French clock movement plate and an old telegraph operating machine. And the Goebel's Exhibit No. 12, on the opposite side of the page, is the one which I described as having the knife in the plate in the slit."

Q. 54. "Can you identify any of the other cuts of planers shown upon these pages of The Electrical World?"

A. "Yes, I remember them, but not to my recollection at 500½ Grand street. I remember the Exhibit Nos. 12 and No. 8 at 500½ Grand street."

Counsel for respondent offers in evidence pages 295 and 296 of The Electrical World of April 22, 1893, above referred to, and requests the notary to mark said sheets "Respondent's Exhibit, W. A. Goebel, 'B.'"

Q 66. "I hand you a page of The Electrical World of Feb. 4, 1893, page 79, containing cuts of lamps, marked respectively, 'Exhibits 1, 2 and 3,' and ask you to state, to the best of your knowledge, what are represented by each or any of said cuts?'

A. "These lamps that I look at now are the same as my father made."

He is then called upon to discuss in detail the various parts of the lamps represented in The Electrical World, and counsel for respondent offers in evidence this page 79 from The Electrical World of Feb. 4, 1893, and requests the notary to mark it "Respondent's Exhibit, W. A. Goebel, 'C.'"

CROSS-EXAMINATION OF WM. A. GOEBEL.

Wm. A. Goebel has been speaking of the cement which his father used to join the carbon to the leading-in wires.

X. Q. 140. "Was this cement a secret cement?"

A. "We could buy this cement in a store in a rougher form, then my father would prepare it, and no one knew what it was."

X. Q. 142. "What was this rougher material?"

A. "Dixon's stove polish; it came in cakes with a blue wrapper around it."

X. Q. 143. "And this material your father worked up, put in bottles and gave to Otto for the American Electric Light Company. Is that it?"

A. "My father had this cement long before we ever thought of working for any electric light company, but when Otto started to work for the Electric Light Company he gave Otto lots of it."

X. Q. 165. "Did your father make barometers and thermometers, at any time, to your knowledge?"

A. "Yes sir. He made some taller than himself."

X. Q. 166. "When?"

A. "At 500½ Grand street and 468 Grand street."

X. Q. 167. "Did he make these barometers and thermometers to sell?"

A. "I don't know. But he always had one or two in front of the store, so people could tell the temperature when they passed. It was a sort of advertisement for the store.'

X. Q. 168. "Did your father make many barometers and thermometers?"

A. "Yes; he made quite a good many."

X. Q. 189. "How did your father come to be employed by that company?" (The American Company.

A. "I really think it was after my brother brought one of the lamps my father had and showed it to the members of the company."

X. Q. 190. "How positive are you about this; state all the circumstances that lead you to this belief?'

A. "My mother and father and my brother Otto and myself was in the work-room, we were talking about electric light works, and my father told Otto that if he thought it would help him any he would let him take one of his lamps down to Centre street and put it on the dynamo, or try it. This was two or three days after my brother started to work for the electric light company. My brother told him that he thought it would be a big thing for himself and my father too, so my father twisted the lamp around in his hand four or five times, and I thought he wasn't going to give it to Otto, and then he told Otto to take it, and Otto took it and put it in a box and wrapped it in cotton, and after Otto went home my father said to us: 'Now we can tell how it burns on a dynamo.'"

X. Q 192. "What shape was the lamp your father gave Otto for the Centre street company and the lamps you have termed 'good lamps'?"

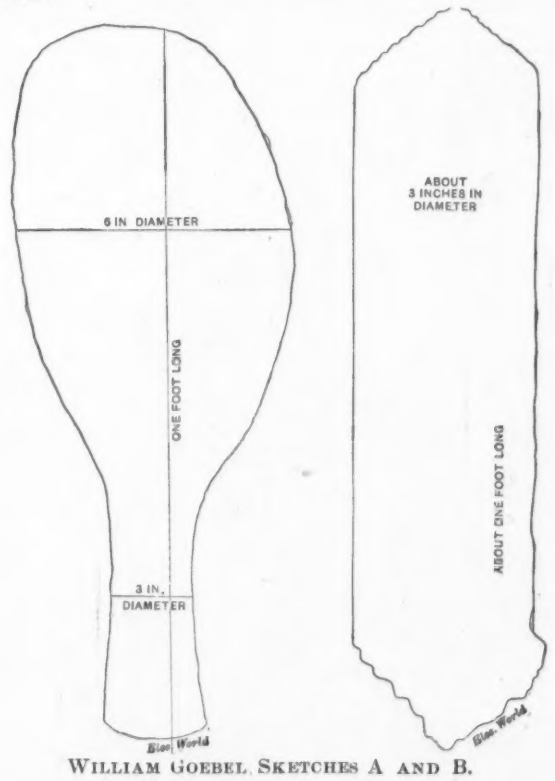
A. "It was a tube—the one he gave Otto; they were all tubes."

X. Q. 234. "What things do you remember that he (your father) experimented on after he ceased to work for the American Electric Company?"

A. "He made lamps for himself and was experimenting on a light that looked something like an arc light in a globe, and in this globe there was a vacuum, and it was so arranged by turning the lamp that the two carbons would go closer together, and by twisting the light the other way the carbons would go farther apart."

X. Q. 237. "How were the outer glass parts of these lamps shaped, and who prepared them?"

A. "The glass tube was about six inches in diameter, and about a foot long, and about three inches from the bottom of the lamp the tube was about three inches in diameter. I make a sketch of this lamp, which I now present."



WILLIAM GOEBEL SKETCHES A AND B.

Complainants' counsel offers in evidence the sketch just produced, and the same is marked "Complainants' Exhibit Wm. Goebel, Sketch A."

X. Q. 244. "Do you remember any kind of an arc incandescent lamp at 500½ Grand street?"

A. "I remember an arc incandescent light, but it was different from this one (Goebel sketch A)."

X. Q. 245. "Can you make a sketch of this arc incandescent lamp you remember at 50 ½ Grand street?"

A. "No; not to satisfy myself."

X. Q. "Well, can you make a picture of any of the shapes?"

A. "No; no particular one, but I could draw the outside part of the glass."

X. Q. 248. "Well, please do so."

A. "I make such a sketch. The glass tube that this lamp was placed in was about three inches in diameter and about a foot long, and the glass was blown together at the top and bottom after the machinery was put inside with wires leading out of it; some had four wires leading out, and some had two."

Complainants' counsel offers in evidence the sketch just produced; the same is marked "Complainants' Exhibit, Wm. Goebel, sketch B."

X. Q. 253. "Used your father blow the glass parts of

these arc incandescent lamps, at 500½ Grand street, himself?"

A. "Yes, out of glass tubes."

X. Q. 264. "What luck used he have in this glass blowing?"

A. "Very poor luck. Sometimes they would crack."

X. Q. 265. 'How about the shape, was he able to get that uniform?"

A. "No. That is why in Exhibit Wm. Goebel Sketch 'B,' i'ts bungling on the ends."

X. Q. 266. "You meant this bungling on your sketch 'B' to show that this lamp was not nicely finished?"

A. "Yes, sir."

X. Q. 289. "How were the incandescent lamps at 500½ Grand street made to stand when burning?"

A. "They hung down on wires."

X. Q. 290. "Was there any socket or other receptacle used for the incandescent lamps?"

A. "No, sir."

X. Q. 291. "How about the incandescent lamps at 468 Grand street?"

A. "They were hung down, and I don't believe there was ever any socket, but while we were at 468 Grand street my father had a big lathe and one day he turned a piece of rubber so it would fit over the bottom of the lamp; and he would fasten this piece of rubber onto the lamp; then he turned another piece of rubber—hard rubber, both pieces—so it would fit over his first piece of rubber that he had fastened to the lamp, and he led wires through it and he adjusted it so that when he would turn the lamp round to the left it would light, and when he turned it to the right it would go out."

X. Q. 296. "And the first switch employed at the lamp was the rubber-turned switch you spoke of before at 468 Grand street?"

A. "That was the first rubber switch, but I remember my father making something for the bottom of the lamp—I don't know whether it was a switch or not—but he made it out of plaster of paris, all of it."

X. Q. 318. "Who do you remember making tubular incandescent lamps?"

A. "August Heger."

X. Q. 319. "Did August Heger make many of these tubular lamps while he was working for your father?"

A. "No, not many; he made mostly bulb lamps."

X. Q. 320. "What was the difference between Heger's tubular lamps and your father's?"

A. "Heger's lamps had a different sealing-in, and more glass was used on the inside?"

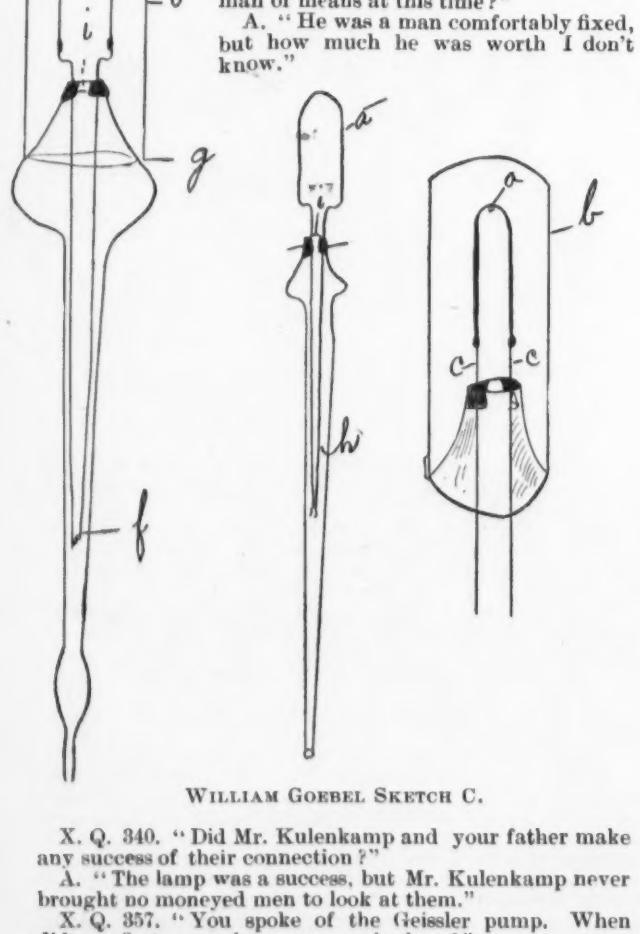
X. Q. 321. "If you can, please make a picture of Heger's tubular lamps?"

A. "I make a sketch. Fig. 1 shows Heger's finished lamp, in which 'a' represents the carbon filament; 'b' the glass tube; 'c C' the leading-in wires of platinum connected to the carbon. Fig. 2 represents the carbon filament connected to the leading in wires and a blown glass tube having a thickened upper portion in which the leading-in wires are tightly sealed. Fig. 3 represents the tube shown in Fig. 2, connected to the lamp before sealing off. Fig. 2 represents the glass and carbon filament ready to be placed in tube 'b'; after it has been placed in tube 'b' it looks exactly like Fig. 3, and it was given then to August Heger, and he would finish it off so it would look like Fig. 1. I omitted to say that when Fig. 2 was placed in tube 'b' it was sealed at 'g,' Fig. 3."

X. Q. 322. "The part which I mark 'h' was a hollow tube expanded at the top with a hole through it so that when placed in the tube 'b,' as shown at Fig. 3, the pump could draw the air out of the tube 'b,' through the hole in 'h'—this hole I mark 'i'?"

A. "It was."

Complainants' counsel offers in evidence the sketch just produced, and the same is marked, "Wm. Goebel, Sketch C, Heger Lamp."



William Goebel Sketch C.

X. Q. 333. "Did you know Mr. Kulenkamp?"

A. "Yes, sir; he was supposed to be my godfather."

X. Q. 334. "Was he connected with your father in the electric business, to your knowledge?"

A. "Yes, sir."

X Q. 337. "Was Mr. Kulenkamp a man of means at this time?"

A. "He was a man comfortably fixed, but how much he was worth I don't know."

X. Q. 340. "Did Mr. Kulenkamp and your father make any success of their connection?"

A. "The lamp was a success, but Mr. Kulenkamp never brought no moneyed men to look at them."

X. Q. 357. "You spoke of the Geissler pump. When did you first see such a pump, and where?"

A. "The first one of them that I ever see was at Centre street. I was bringing some carbons to the company there to my brother Otto. I don't know if it was a Geissler pump, but they were pumping out lamps with it. My father had some kind of a pump at 500½ Grand street, made out of glass, but it was broke; whether this was for pumping out lamps or not, I don't know. After my father went to 468 Grand street, he had made a pump that looked like the pump that was broke at 500½ Grand street, but it had an elevator on it and lots of little other fixings. When the pump was at 500½ Grand street it was covered up with a sheet, and us children was never let to go near it."

X. Q. 361. "And at 468 Grand street your father had another pump. Did this operate by mercury?"

A. "Yes, sir."

X. Q. 365. "Was this the only pump your father had at 46‹ Grand street?"

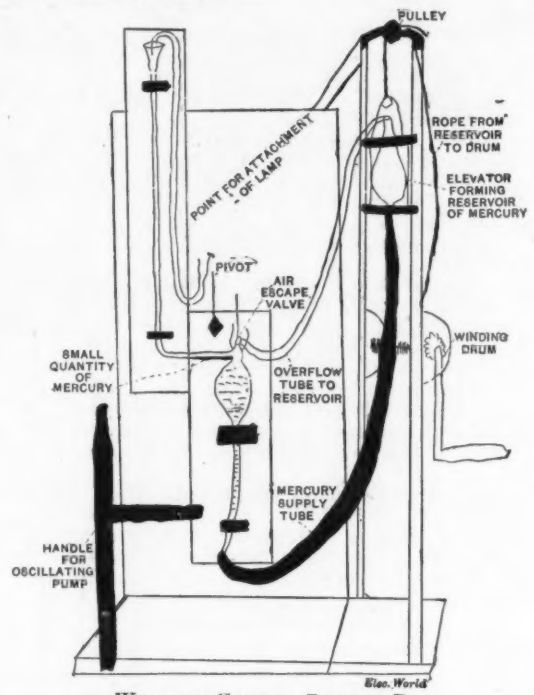
A. "No; he had two pumps there."

X. Q. 363. "What was the other one?"

A. "It was pretty near the same as the other one with the elevator, as this one also had an elevator."

X. Q. 369. "Will you make a drawing of the pump your father had made at Pearl street, with the elevator on it?"

A. "I am not quite sure about the pump being made on Pearl street, but it was made outside of the shop. I don't know who made it. This is a drawing of the pump as nearly as I can remember it."

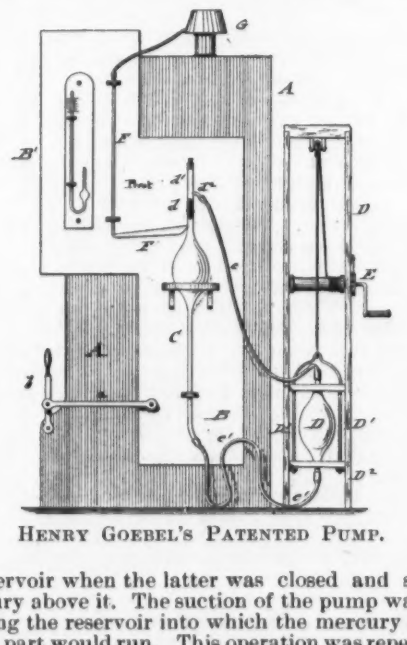


William Goebel Sketch D.

Complainants' counsel offers in evidence the sketch just produced, and the same is marked, "Complainants' Exhibit, Wm. Goebel, Sketch D, Pump."

X. Q. 370. "I will describe this 'Goebel Sketch D,' as I understand said sketch and your verbal description of it.

"The parts of the pump were supported from a backboard and base of wood, and the entire pump could be carried from one place to another. Supported on the backboard at the point I have marked 'pivot,' so as to swing, was the part to which the lamp to be exhausted was attached. This part was caused to swing by the movement of the handle, as I marked on the sketch. Supported on the base at one side of the swinging part was an upright, having at its top a pulley and carrying about midway a winding drum from which a rope passed over the pulley to a reservoir of mercury having an up-and-down movement on the upright by means of said winding drum, from which reservoir rubber hose ran to the glass part of the swinging portion of the pump. A smaller rubber tube ran from the top of the reservoir to a point above the air escape valve on the swinging portion of the pump. The several parts are marked in the drawing so as to need no letters of reference. The operation of the pump was as follows: The lamp to be exhausted was attached to the place indicated in the sketch and by the movement of the handle the swinging portion of the pump was tilted so that the small quantity of mercury in the horizontal tube would flow over and form a trap to prevent the escape of air to the lamp through the tubes to which the lamp was attached. When this seal was effected, then the movable reservoir of mercury was raised by operating the drum—the air in the parts of the pump below the seal escaping through the air escape valve, and that valve being itself sealed by the mercury, any excess of which would be returned through the overflow tube to the reservoir when the latter was closed and sealed by the mercury above it. The suction of the pump was caused by lowering the reservoir into which the mercury from the swinging part would run. This operation was repeated several times—sometimes as often as five or six—as often as was necessary to effect complete exhaustion. Is this description substantially correct?"



Henry Goebel's Patented Pump.

A. "Yes, it is correct; but when we lowered the reservoir we moved the handle so as to throw the small quantity of mercury in the tube—the horizontal tube—back to its original position, leaving the tube clear so as to allow a free passage for the air."

X. Q. 371. "Will you make a sketch of the pump at 500½ Grand street?"

A. "I have made a sketch as near as my memory recalls the pump. This pump was generally covered up with a white sheet and I very seldom saw it."

Complainant's counsel offer the sketch just produced in evidence and the same is marked "Complainants' Exhibit, Wm. Goebel, Sketch E, Pump."

X. Q. 372. "Please describe the parts of 'Goebel, Sketch E, Pump,' and state how it operated?"

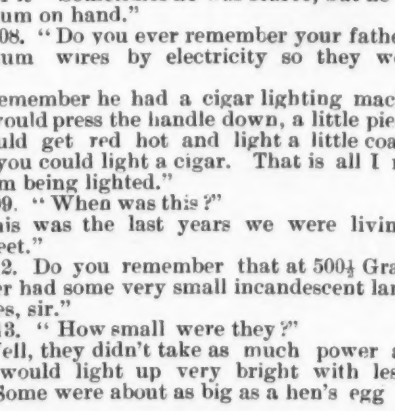
A. "I never see this pump operate, to my knowledge. I have marked where the pump was broken with the words 'Broke here'; 'a' is a rubber hose: at 'b' was the quantity of mercury I spoke of. The operation of the pump was never explained to me and I can't tell you how it operated. Everything unmarked, except the blackened parts, was glass."

X. Q. 396. "At 500½ Grand street what sort of a furnace did your father have?"

A. "My father had a furnace made out of a cylinder of iron, like a boiler, and it was riveted."

X. Q. 397. "What kind of a furnace did your father have at 468 Grand street?"

A. "We had one of the same furnaces: then when he went to work at the electric light company they put in a new furnace made of firebrick, and my father couldn't get the heat very well from this, so he took it out and put in his old one. It was in a back room, four rooms back from the store."



William Goebel Sketch E.

X. Q. 399. "Was this furnace a jeweler's furnace?"

A. "It was a furnace that was his own idea, and I never saw another one like it."

X. Q. 403. "Was your father often short of platinum, or did he have enough of it around the shop for ordinary use?"

A. "I remember one time, at 500½ Grand street, when he had a piece of platinum; it was flat, and about an inch and a half long and about a sixteenth of an inch thick and about a quarter of an inch wide; he took this platinum and run it through draw plates and made a long piece of wire out of it Sometimes he was scarce, but he generally had platinum on hand."

X. Q. 408. "Do you ever remember your father heating the platinum wires by electricity so they would give light?"

A. "I remember he had a cigar lighting machine that, when he would press the handle down, a little piece of platinum would get red hot and light a little coal oil lamp and then you could light a cigar. That is all I remember of platinum being lighted."

X. Q. 409. "When was this?"

A. "This was the last years we were living at 500½ Grand street."

X. Q. 412. Do you remember that at 500½ Grand street your father had some very small incandescent lamps?"

A. "Yes, sir."

X. Q. 413. "How small were they?"

A. "Well, they didn't take as much power as the big ones and would light up very bright with less battery power. Some were about as big as a hen's egg and some smaller."

X. Q. 414. "Do you remember any of these small lamps being used at 500½ Grand street?"

A. "Yes, sir."

X. Q. 417. "These small lamps, then, were only used to see if they would burn, is that it?"

A. "No: we knew they would burn all right."

X. Q. 418. "What did you do with them: tell us all you remember about them?"

A. "I have seen my father show them to people and talk about them."

X. Q. 419. "Do you remember how long these small lamps, or any of them, burned at a time?"

A. "Oh, they burned as long as the current was turned on; that would be about ten or twenty minutes, and then, again, my father would only turn them on about two or three minutes."

X. Q. 420. "How many of these small electric lights were there at 500½ Grand street?"

A. "I have seen as many as seven or eight."

X. Q. 422. "Did your father make many of them at 500½ Grand street?"

A. "I have seen him make about that many of these small ones."

X. Q. 423. "Did you consider these small electric lamps better than the large tubular ones?"

A. "Yes, sir."

X. Q. 424. "Tell us why?"

A. "The small ones could be run with one or two jars."

X. Q. 425. "How big was the light-giving part of these small lamps?"

A. "About a quarter of an inch long."

X. Q. "Did you see any of the exhibits, 6, 7, 8, 12, made?"

A. "No, sir; I never saw any of them made. I see my

father make two, and he sold them or gave them to some man that came to the house. This man was from some electric light company. I mean I saw him make two planers."

X. Q. 454. "Which of the exhibits 6, 7, 8 and 12 were the two planers your father sold, or gave away, like?"

A. "One was like 'Goebel's Exhibit No. 12,' and the other like 'Goebel's Exhibit No. 8,' but it was better finished—both of them."

X. Q. 455. "Did I understand you that at 500½ Grand street you knew only of the use of the two coarse planers?"

A. "No, sir; it was 'Goebel's Exhibit 8' and 'Goebel's Exhibit 12' that I remember at 500½ Grand street."

X. Q. 456. "Where do you remember exhibits Nos. 6 and 7?"

A. "I remember them at 468 Grand street."

X. Q. 457. "Did your father make these planers, 'Exhibits 6 and 7,' at 468 Grand street?"

A. "I believe he did."

X. Q. 484. "Were there any incandescent lamps upstairs at 468 Grand street that were lighted either from the batteries or dynamo?"

A. "Yes, sir."

X. Q. 485. "Tell where they were, and how many?"

A. "There was one over a clock; that is all I remember. That was operated by a switch that was on my father's bed, from the battery down in the store; the bed was upstairs where the clock was, in the front room, my father's bedroom, and he could turn on the switch, and the light would light that was hanging over the clock, and he could see the time."

X. Q. 494. "You didn't see them working by the light of the lamps? Except Otto, as you stated?"

A. "No, sir; not to my recollection, but I have seen my mother read to my father by an electric light both at 500½ Grand street and at 468 Grand street."

X. Q. 524. "You said your father made automatic movements; what did you mean by that?"

A. "He would put movements in figures, and the figures would move their eyes and change their teeth, and turntables would move around, and sets of teeth would open and close, and signs would change, all by the one movement."

X. Q. 525. "Did your father do much of this work, and at which store?"

A. "At both stores; he was constantly repairing the automatic figures that he made for Dr. Petaire, the dentist on the Bowery, whenever they would get out of order. He also made lots of different kinds of automatic movements for Dr. Petaire's own private use."

X. Q. 526. "Did your father make these automatic movements for anybody else?"

A. "Yes, sir; he made one for a dentist in Brooklyn, by the name of Dupignac, on Prospect street, I think."

X. Q. 527. "Did he make any more automatic movements?"

A. "He made a case about four feet long and four feet high and about a foot deep; in this case there was a scene—a country scene with hills and rocks; and on these hills and rocks there were tin houses so as to represent old-fashioned houses, and, in this case, on the rocks there was one figure of a jack and a lady driving him, and every time she'd hit the jack with a stick the jack would kick twice. Down below that on the rocks there was a scissors grinder grinding a pair of scissors, and once in a while he would take the scissors up to look at them; on the other side there was a windmill running, there was a train of cars moving, chickens picking, a water wheel turning and a ship moving. He made it to order for Dr. Petaire. This was made at 500½ Grand street."

X. Q. 562. "What kind of a crucible did your father use at 500½ Grand street for carbon making?"

A. "A black one, not metal, but some sort of a hard material like stone. It was about three inches and a half on the inside and about seven or six inches deep, and he had smaller ones that was only about two inches wide and about four inches deep."

X. Q. 563. "What kind of crucibles did your father have at 468 Grand street while he was baking carbons for the American company?"

A. "The first carbons he baked for them he baked in these crucibles, and they thought he could bake them better in a nickel box, and, after trying it, he gave the nickel boxes back and said they were no good."

X. Q. 591. "Which of the planers 7, 8 and 12 was used for fine work, and which for coarse, at 500½ Grand street?"

A. "No. 8 and No. 12 for fine work. Goebel's Exhibit No. 8 was to flatten, and Goebel's Exhibit No. 12 was to make narrow."

X. Q. 612. "At 500½ Grand street did you ever see with your father a lamp which had a bottom part projecting upward into the lamp like the bottom of a bottle—champagne bottle—or like the bottom of the Heger lamp, sketch 'C'?"

A. "Heger's lamp was made from two pieces; my father had a lamp something like the Heger lamp, but it was one piece. The end of the tube was sucked in while it was hot, and the Heger lamp was placed there when it was cold and heated and sealed in there. That is the difference."

X. Q. 613. "When finished, how did your father's lamp and Heger's lamp compare as to looks—I refer to the lamps with the bottle bottom?"

A. "My father's was hollow at the bottom like a champagne bottle, and Heger's was closed, as I have shown it in sketch "C," Fig. 1.

X. Q. 620. "How did your father, before he worked for the electric light company, bring his leading-in wires inside the lamp chamber—I refer to both places on Grand street?"

A. "He heated the bottom of the tube until it became small so as he could insert the carbon filament in the tube without the carbon touching the bottom of the hot tube. Then he would heat the bottom of it to almost melting heat and then squeeze it with a plyer, and sometimes he would leave it go together itself without squeezing it; and then from the upper part of the lamp, through a hole, he would suck it in, and when he would suck it in, that made the lamp like a champagne bottle at the bottom; but when he would flatten or squeeze it with the plyer, it would look flat and he wouldn't suck it in."

X. Q. 673. "At 500½ Grand street did your father wrap his splints, after putting them on a mold, in tissue paper?"

A. "He was doing that as long as I can remember."

X. Q. 674. "What material was the mold made of, and what was its shape?"

A. "It was a solid piece of carbon, about half an inch thick and about two inches and a half long and as wide as the inside of the carbons and round like a hairpin on one end."

X. Q. 675. "How many splints were put on a single mold?"

A. "Sometimes seven and eight, according to how thick the mold was."

X. Q. 676. "And how were the splints secured in place on the mold?"

A. "By being bound around the bottom with thread; there was a piece of paper placed between the splints and the thread to keep them from getting loose or cut by the thread, and to keep them from shrinking."

X. Q. 707. "When your father exhausted his incandescent lamps by means of the long bent tube dipping into a bowl of mercury, did he, while exhausting the lamp, pass any current through the carbon?"

A. "I have seen him do that at times."

X. Q. 708. "Where did you see that done?"

A. "At 500½ Grand street."

X. Q. 712. "At 500½ Grand street, did your father have any trouble with the carbons breaking while exhausting the lamps?"

A. "He would break a carbon once in a while."

X. Q. 713. "But this was not a serious matter, was it?"

A. "Well, if he wasn't careful he would break every one of them."

X. Q. 714. "What care had to be exercised to avoid breaking carbons during exhaustion at 500½ Grand street?"

A. "Well, when the mercury was coming out, if he shook the lamp on the rod it would break the carbon; the mercury would break the carbon."

X. Q. 718. "What other material besides bamboo did you see your father use?"

A. "I never see him use anything else to my knowledge but bamboo; but he was experimenting with thread and different kinds of wood; when he baked sometimes he would put two or three pieces of thread and other kind of wood besides bamboo around the mold in the same bake with the bamboo, and then he would try them, but it was always a fizzle."

X. Q. 719. "When did he do this?"

A. "At 500½ Grand street."

X. Q. 735. "How did your father tell you to know a perfect vacuum at 468 Grand street?"

A. "I knew a perfect vacuum at 468 Grand street, according to my father's ideas."

X. Q. 736. "Well, at 500½ Grand street, how did he tell you?"

A. "He showed me by taking a lamp that was burnt out, and put a bowl of mercury on the table, and took a pair of pliers and dipped the lamp with one hand into the mercury and took the plier in the other hand and dipped the plier into the mercury, and while the tip of the lamp was under the mercury, where he had sealed it off, he broke it with the plier, and through the small hole that he had broke in the point of the lamp the mercury had forced its way in and filled the lamp."

X. Q. 790. "Then the same set of batteries would run two lamps at the same time?"

A. "Yes, sir."

X. Q. 791. "Any more than two?"

A. "Well, he could put on three or four, but they wouldn't be so bright."

X. Q. 792. "And if one of these two or three or four lamps when turned on wouldn't burn, the other wouldn't burn, is that it?"

A. "Sometimes while there were four burning, if one of the four went out the other three would burn, but get a little brighter."

X. Q. 793. "Then, a number of cells were not used to operate a single lamp at a time and a second number of cells another lamp, a third number of cells another lamp; but the lamps were operated from the entire set of cells, is that right?"

A. "I don't understand how the batteries were connected, but I know they was all together, and when my father put on a horseshoe carbon lamp, that was long, and at the same time put on a meat-saw lamp, the meat-saw lamp would burn brighter than the long carbon horseshoe lamp."

X. Q. 794. "In other words, all the lamps lighted at once would grow brighter or dimmer at the same time."

A. "When we would have two lamps burning at one time—a meat-saw lamp and a hairpin carbon lamp—the meat-saw lamp would be very bright, much brighter than the hairpin lamp; but if we turned off the meat-saw lamp, the hairpin carbon would get bright—very bright; and if we turned off the horseshoe lamp—I mean the hairpin lamp—and let the meat-saw lamp burn, the meat-saw lamp would get very, very bright."

X. Q. 852. "In this letter your brother mentions sending you a copy of The Electrical World of April 22 and also of April 29; did you receive both of these copies?"

A. "No, sir. I asked at the post-office that day, and for three or four days after, and never received them. I sent a letter home to my brother, asking if he failed to mail them papers, meaning The Electrical World, and I have received no reply."

MR. KENYON'S ARGUMENT.

Mr. Kenyon also followed very much the lines of his previous argument in St. Louis. In speaking of the Edison patent, he showed that the coiled filament was the specific thing called for, and had a distinct utility and function in the art; namely, the conservation of heat. That, he claimed, was the invention of the patent, and was amply sufficient to warrant a patent. He said that the contention of the defense at the final hearing would be non-infringement, but that for the present it takes the form of anticipation, as the elements described are old in the Goebel matter. A patent (according to custom) must be construed by the state of the art. Judge Wallace had construed the Edison patent by the state of the art as it was presented to him at that time. The nearest approach there disclosed was Edison's French and English platinum lamp, which consisted of an all glass receiver containing a vacuum within and a filament of platinum. It had every element except the carbon filament, which, however, did the same work, namely, gave light. The Circuit Court of Appeals also fail to find in the art a carbon filament. He quoted Judge Wallace as follows: "It is impossible to resist the conclusion that the substitution of the filamentary carbon opened the way to a sub-division of the electric light." He maintained that had the carbon filament been shown to have been a part of the state of the art at that time Judge Wallace's decision would have been just the reverse, for he says so himself. There is in this no question of law or supposition. "Our case," he says, "is now and will be in the final hearing, that there was a filamentary carbon in the prior state of the art prior to Oct. 12, 1879." He then went on to show what, in the meaning of the court, constituted a filamentary carbon, giving the list of those which had already been adjudged to be infringements of the Edison patent because of their filamentary character, which for the sake of reference will be repeated here.

"Stated in terms of the diameter of a circular cross-section, the important carbons, according to Prof. Barker's table and of this case, are, after carbonization, as follows:

FILAMENTARY BURNERS.

Tar putty wire of patent	.005 inch
U. S. "tamidine" lamp	.006 "
Beacon lamp	.007 "
Oconto Defendant's lamp	.007 "
U. S. "Zigzag" lamp	.008 "
Goebel lamp No. 4	.009 "
Goebel lamps	.008 to .010 "
U. S. "M" lamp	.013 "
Patent Office model	.015 "
Largest cotton thread	.015½ "

Those which are larger than these and adjudged to be rod burners are the following:

ROD BURNERS.

Sawyer-Man smallest	.031 inch
Millimetre carbons	.040 "
Sawyer feeder lamp	.050 "
Adams, accidentally small	.050 "
Konn	.063 "
Adams lamp	.057 "

It will thus be seen that, the Goebel lamp No. 4 being .009 of an inch in diameter, and the defendant's lamp in this case .007 of an inch in diameter, both stand well as filamentary burners. He replied to the attack made of the lamps 1, 2 and 3 on account of their copper and iron leading-in wires, by stating that Goebel had reproduced lamps with similar leading-in wires, and so had the other side, which were capable of burning. He also called attention to the smoked appearance of some of the original exhibits, which show that these very lamps had been raised to high incandescence, and read the statements of witnesses on the other side to the effect that this clouding was due to a high incandescence, long continued in a hot vacuum.

In criticising Upton's, Barker's and Howell's statements, he said that none of them had stated that they did not believe that any of these lamps do not embody the elements claimed for them. Upton had claimed that these lamps, the lamps tested, should have burned 100,000 hours under the conditions. Mr. Kenyon said that his calculation of this meant that they would have had to burn continuously for 33 years to have satisfied Mr. Upton that they were practical lamps. The sole criticism made by these gentlemen was that the lamps lacked efficiency and length of life.

As regards life, he quoted Mr. Edison's testimony to show how long a lamp should burn to be a commercial success. In an interference suit between Edison and Swan, Mr. Edison was examined as a witness on his own behalf. Among other things, Mr. Edison, in speaking of the durability of his lamps in 1879 and 1880, testified as follows:

Re-X. Q. 452. "In 1879 how long did you consider that an incandescent filament should burn in order to constitute a lamp which you would have considered a commercial success, or an improvement of any practical benefit to the public?"

A. "That would depend upon the economy of the lamp. With the lamps we made in the latter part of 1879 and the early part of 1880, with the economy that they then had, 100 hours would have been a commercial success; a greater length of time would have made them of a greater commercial success."

And yet some of the reproduced lamps of Goebel's had considerably exceeded this limit set by Edison. It had been claimed that a commercial success was not necessary in a claim prior to this. In the case of Sawyer & Man vs. Weston the patent was held invalid because of public use of Sawyer & Man more than two years before application of Weston, whose patent was sued on. In this case the Court says: "A public use does not depend upon the number of persons to whom the use is known, and it is enough if a skilled device embodying an investigation is publicly used by even one person. Before the experiment of Sawyer & Man in March, 1878, concerning their lamp with a view of increasing its efficiency and commercial value, and did not relate to the carbon treatment itself, which was perfected in March, 1878, and required no subsequent test. Now, it may be that the Sawyer & Man lamp did not prove to be the success the inventors supposed it to be, and that no perfect incandescent electric lamp was produced until the fall of 1880, but still the Sawyer & Man lamp was capable and operative, and had some practical utility. That it was not a commercial success is not here a controlling consideration."

Mr. Kenyon claimed that the evidences disagreed, since the Beacon case proves conclusively that Goebel did not abandon his work. It is more fully proved in this case than it was at St. Louis by the testimony of Goebel's children, who were too young to know of his earlier work, but who testified as to his later work in the seventies. He characterized this case as essentially a case of theory against fact. Six hundred and fifty (650) pages had been added to the record in this case by the defendants. He said that he never had known a case prepared for final hearing that had been prepared with the same care and conscientiousness as had been this case.

As regards the charges of dishonesty made by the complainants' counsel, he made a somewhat affecting claim of his own and associate counsel's integrity and a general and emphatic denial of any and all imputations against himself and those associated with him.

Mr. A. P. Smith made a statement as to how some of the affidavits were obtained, which he made as an officer of the court and with the same care as he would were he under oath.

Reviewing the new testimony offered by the complainants, Mr. Kenyon referred to the discomfiture of the latter resulting from the last affidavit of Mary Meisinger; so with Fitzpatrick's affidavit. The accuracy of his affidavit to the defendant and the inaccuracy of his affidavit to the complainant had been fully proved. Lizzie Opry's deposition, he says, is a remarkably clear one, and disposes of Henry Goebel, Jr.'s, and Heger's statements as regards lamps Nos. 1, 2 and 3. That Mr Opry and Mrs. Zimmermann both disposed of the claim that the planing machines were made in 1883. Heger says the tool was made in 1883, and so does Max Hoffman. Perkins saw these tools in 1880 and bought three tools in 1883. Wm. A. Goebel disposed of Korwan's claim of having made the tool in 1883. Korwan may have made such a tool at that time, for Wm. Goebel speaks of duplicates of No. 8 and No. 12 having been made in 1881, and given to an electrical company. Wm. Goebel also disposes of Henry Gobel, Jr.'s, claim to having made lamps 1, 2 and 3, and Heger's to have made No. 4 in 1883, and gives a drawing of the one that Heger did make. Heger makes a great effort to show that there were no tools at the time that he worked for Goebel. He says that there was but one room in which work was ever prosecuted. The defense has shown that there were four rooms. He then stated that it now turned out that the complainants had been visited by the defendants' witnesses. Fitzpatrick, Meisinger, Sebastiani, Mrs. Opry, Finck and Henry Goebel,

Jr, had all been approached. He believes that this $30,000,000 trust is behind all of this.

CHARGES OF BRIBERY.

Continuing, Mr Kenyon said:

"Nicholas Finck is a poor, sick, old man, yet a respectable man, having his house and home in Elizabeth, N. J. He was one of the defendant's witnesses, in the St. Louis case, to Mr. Goebel's earliest making and use of the alleged Edison invention. He understands mechanics, is an inventor—invented, among other things, a can lock, and left his patent for it at the office in New York of a comparative stranger, one R. D. Gibby, for sale. After a while, and later than the date of Mr. and Mrs. Finck's affidavits for defendants in the Columbia case, Gibby goes to Mr. Finck's house in Elizabeth, and in the course of a conference there, tells Mr. Finck, in the presence of Mrs. Finck and a son, that he (Gibby) has found a man interested with Edison, who can get from Edison, or the Edison people, $1,500 for Mr Finck before 2 o'clock that day for his patent, if Mr. Finck can be mistaken in his affidavit for defendants. The evidence of this disgraceful proposition is found in the testimony of Mr. and Mrs. Finck, of their son, and of Mr. Gibby himself (Defendants' Depositions, pp. 80, 166, 140, 161 and 105). Gibby, who had to be subpœnaed by defendants, says in his deposition something to the effect that Mr. Finck at one moment acceded, or seemed to accede, to his proposition, by saying in substance that he didn't know how he could arrange his statements. But Gibby says he can fix that.

Gibby was under subpœna, a hostile witness, and is not to be believed in his intimation that Finck was at any time ready to accede to his proposition. The fact that Finck did not accede to Gibby's proposition belied Gibby's insinuation. Moreover, Gibby admits on the record that he lied, wilfully lied, to defendant's counsel to avoid obeying at once the subpœna served upon him, in having stated that he was under subpœna in another case, which he admits was not true, but made up for "bluff." He wanted, in the mean time, to talk with the other side, with McMahon or Wilson, or some other representative of the Edison people. But even if Mr. Finck, a poor man, old and sick, did waver for a moment, which we utterly deny, the pressure of the temptation spread before him and his uprightness in resisting it are only the more apparent.

An examination of the deposition for defendants of Mr. and Mrs Finck, of their son and of Mr. Gibby are warrant for the above statements.

Baldwin Sebastiani, another of the defendants' witnesses, has, since the date of his affidavit for defendants, been called to the office of a lawyer for complainants, named Campbell, and given to understand that he could have money, which was placed on the table before his eyes, if he could swear different from his affidavits for defendants. He says the money wasn't offered him, but he guesses he could have had it if he would swear different.

With Henry Goebel, Jr., the methods of bribery were successful. He is evidently the weak member of Mr. Goebel's family, and was the right person to be dishonestly approached. Prior to about two months ago, more or less, he had for some time been aiding defendants to hunt up the people who were likely to know about his father's early lamps. During this work he from time to time brought reports to defendants' counsel that he had received offers of large sums of money—once many thousands of dollars—to leave the defendants and serve the complainants. His stories of attempted bribery by complainants became larger and larger. He became more and more restless and unmanageable, and defendants were at last forced to give him to understand that they distrusted him. Very shortly after this he stated to defendants' counsel that he had secured employment at Nagelsmith & Rothschild, 510 Broadway, and should not help defendants any longer. This statement was false. He did not enter that employment, nor any other, except it be complainants'. He had, previous to this defection, been in the habit of helping care for his father, and of coming to the office of defendants' counsel, 38 Park Row, almost daily. He came there no more. From that date he had had large sums of money at times, and has given evidences of having plenty of money; has been intoxicated a great part of the time, unfit to be conferred with or examined as a witness, even if defendants were disposed to subpœna him, which they are not. He has been a constant, wilful annoyance to his father, has tried to persuade him and his other relatives to do "different from what is right," has been brutal to his family. He has been pressed for interviews with defendants' counsel, and has been too intoxicated to know what he was about, and on one occasion when persuaded to come to the house of Mr. W. H. Kenyon, ran away at the end of ten minutes, before he could be conferred with. He has been in association with complainants' witness, Hoffman, very constantly both before and since his defection, and Hoffman has distinctly offered to bribe him to go on the other side. On Feb. 16, 1893, Henry Goebel, Jr., signed the following statement made by him on that date:

'I, Henry Goebel, Jr., of the city of New York, hereby certify that this 16th day of February, 1893, I was approached by Max Hoffman, proprietor of the East Side Hoffman House, corner of Seventh street and Avenue A, New York City, and asked what I would take to go on to the other side. I said I thought I was worth twenty-five or fifty thousand dollars. He then said to me that he thought he ought to make ten thousand out of it, and that it ought to be worth ten or twenty-five thousand to me to go on the other side, or to get out of the country. He then said he would speak to the other party to morrow. He asked me if I would take a certified check? I said No, I would only take money. He furthermore said I would get a position for life in the company on the other side. When Hoffman first spoke to me I answered him, and carried on the conversation to bring him out. This conversation took place between three and four o'clock in the afternoon, in the saloon in the East Side Hoffman House. Later on, between five and six in the afternoon, I went to the office of Witter & Kenyon, 38 Park Row, and immediately told Alan D. Kenyon about the interview with Mr. Hoffman referred to above.

"Dated New York, Feb. 16, 1893.

"HENRY GOEBEL, JR.

"Witness: ALAN D. KENYON."

Mr. Kenyon's closing argument consisted of a citation of the various authorities on the subject.

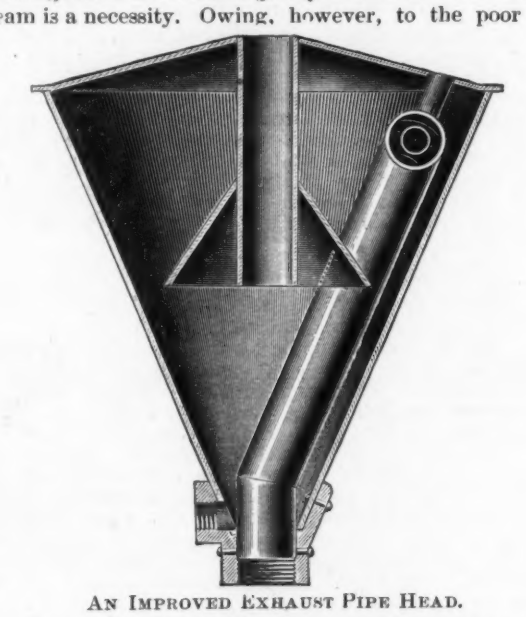
Mr. Mitchell closed for the complainants, occupying the whole of Saturday. He claimed that the history of patent litigation offers no warrant for believing that the Goebel scheme can ever prevail on final hearing. Never has an American Court sustained such an appeal after such an adjudication in a final hearing. The best evidence produced by the defendants consists of an indefinite recollection, or attempt at recollection, after a long series of years. In speaking of the present case, he said that the present defendants did not infringe until two years after Judge Wallace's decision, and that they had not made one dollar investment on the expectation that Judge Wallace's decision would be reversed. The present defendant, when it went into business, did not even know that there was such a person as Goebel. It went into the business with its eyes open, believing that it was infringing, and that it could not make a defense against such a claim, but trusting to luck and circumstances to avoid the penalty of the crime which it was knowingly committing. He saw no reason why they should be dealt with leniently. He stated that there was nothing left in this case but the question of whether lamp No. 4, and its companion lamp No. 9, did or did not come from the brain of Goebel. He said that no lamp had ever been constructed that has been accepted by the public as a substitute of the Edison lamp that was not so exhausted as to prevent air-washing. Such a degree of exhaustion was not possible by the Torricellian method. Unless the vacuum is sufficient to remove what is known as air-washing it is not an infringement of the Edison lamp as interpreted by the trial court. He then rehearsed the antecedent improbabilities of the story. He claimed first that these lamps were not original lamps and capable of operative use. He then took up the questions: 1st, whether No. 4; 2d, whether No. 9; 3d, whether Nos. 1, 2, 3 and 4 planers antedated the Edison patent. He thinks they do not, and proceeded to show why, taking up his inquiry under three heads, 1st, business; 2d, scientific; 3d, legal.

Mr. Mitchell, after arguing many of the points touched upon in Mr. Dyer's opening, then took up the legal side of the case.

The arguments closed late Saturday afternoon. Judge Seaman stated that he hoped to render his decision on Monday, July 17.

The Eclipse Exhaust Pipe Head.

The necessity for the protection of the roofs and walls of buildings from the hot and greasy condensation of exhaust steam is a necessity. Owing, however, to the poor construction and inefficiency of the cheaper exhaust heads designed for this purpose, the New York Exhaust and Blow Pipe Company, of Hartford, Conn., and 136 Liberty street, New York, have devoted great attention to designing a head that, while cheap, will be at the same time efficient, and we illustrate their Eclipse exhaust pipe head, for which they have been granted patents.



AN IMPROVED EXHAUST PIPE HEAD.

The exhaust pipe is carried to near the top, and there discharges horizontally around the head, giving the steam a whirling motion, thereby driving the heavy matter to the outer walls and enabling it to flow down the sides to the drip, letting dry steam only escape out of the centre. In connection with this centrifugal method of trapping, there is a pipe connecting the outside of head and the exhaust pipe in such a manner as to cause a suction when steam is going through, thereby drawing cold air into the head, which aids the condensation.

An Automatic Short-Circuit Alarm Bell.

A new invention for indicating grounds or short-circuits on electric gaslighting apparatus has been placed on the market by A. L. Bogart, 22 Union Square, New York, which is a substitute for the ordinary "cut-off." The device, which we illustrate, requires no special wiring nor local batteries, and the bell never rings unless the circuit has been closed for more than a fixed period. Its time of operation can be varied from one to twenty seconds by means of the set screw. Normally, the bell is not in the circuit. If the battery becomes grounded for a greater length of time than the adjusting screw is set for, then the bell is cut into the main circuit and rings until the trouble is removed or disappears, when it cuts itself out of circuit again and the battery is left in its normal condition. While the bell is ringing its resistance and counter-electromotive force cut down the current to so small an amount that the battery can remain grounded for several hours without deterioration.

AUTOMATIC ALARM BELL.

Portable Electric Fan Outfit.

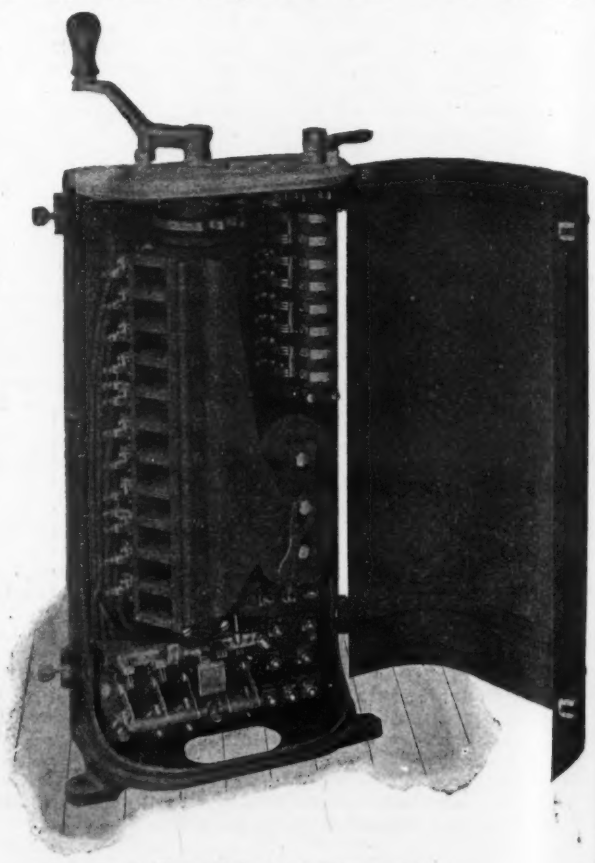
In our issue of June 24 we described and illustrated the Mason fan motor, and illustrate herewith a portable fan outfit with which it is used. As will be seen, the combination is very neat in appearance, and especially suitable for the household.

A PORTABLE FAN OUTFIT.

The Giant power battery, shown within the case, is manufactured by the same firm, the Mason Electric Company, 10 Vandewater street, New York. It consists of a specially constructed hexagon carbon, which exposes a large surface to the solution, which with the carbon is contained in a porous cup of special construction. The zinc cylinder encircles the cup, and the whole is contained in an acid-proof earthenware jar especially designed for this battery, whose dimensions are 10½ inches in diameter and height. The Mason battery powder is used as the excitant, giving the battery a capacity of 300 ampère-hours. Two cells run the motor shown (with a 10-inch fan) at 1,100 revolutions per minute, and three cells give 1,500 revolutions, and the solution gives off no odors.

The General Electric New Controller.

The General Electric Company has perfected a new type of controller, type K, which besides introducing other notable improvements comprises in itself all the necessary controlling movements. As will be seen, the case contains within the regulating device the connection board, motor cut-out switches and reversing switches; rods and bell cranks are entirely eliminated and the necessity for moving parts beneath the floor of the car done away with. Each set of contacts is strongly insulated, and the tendency to arc on making circuit is prevented by means of the mag-



A NEW TYPE OF CONTROLLER.

netic blow-out, which deflects the arc sidewise from the segments and spring contacts and extinguishes it.

The general design of the reversing switch is similar to that of the controller, the segments being carried by a small cylinder and making contact with spring fingers. Movement of the reversing switch handle through 60 degrees changes the combination of the armature leads of both motors and reverses the motion of the car.

The motor cut-out switches attached to the connection board of the controller permit of rapid and absolute disconnection of the motor from the circuit. The value of such an arrangement in case of disablement of motor on the road will be readily appreciated by practical railroad men.

This controller is extremely simple in its mechanical construction and is easily accessible: by loosening two thumb nuts on the outer case it may be opened, and the removal of a bolt in the pole piece allows it to be swung back, giving access immediately to the interior parts.

The sequence of connections and speeds of controller "E" has been preserved, but placing the field on the ground side of the armature has necessitated a modification of the interior connections, admitting, without change, of either the shunt or loop method of control. Proper make and break of contacts are insured by means of a star wheel attached to the upper part of the cylinder shaft. This wheel is actuated by a spring, and throws the pointer positively to the notch on the dial, indicating to the motorman the running positions of the motor.

By means of an interlocking device between the reversing switch and controller the operation of either, unless it is in proper position relative to the other, is impossible. The reversing switch cannot be moved over unless the controller is in the "off" position, nor can the controller be operated while the switch is between its forward and reverse position. A similarly ingenious device insures proper adjustment of the motor cut-outs; thus, should one motor be cut out, the combinations suitable for the other can alone be made.

An Improved Friction Clutch Pulley.

An improved friction clutch pulley called the "Imperial," has been placed on the market by J. W. Penfield & Son, of Willoughby, O., and we present herewith cuts showing the general appearance of the pulley, as well as the principle upon which it is constructed. The novel manner of construction, it is claimed, secures increased efficiency,

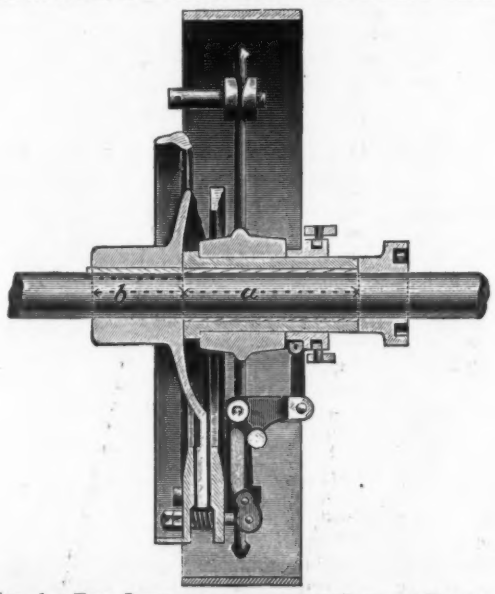


FIG. 1.—THE IMPERIAL FRICTION CLUTCH PULLEY.

durability, ease of adjustment and quickness of repair, and at the same time overcomes the only valid objections heretofore urged against clutch pulleys in general.

As will be seen by examination of the sectional view shown, Fig. 1, the "Imperial" clutch pulley is provided with two circular friction rings, between which is a friction disc. The friction disc is keyed to the shaft and turns with it, while the balance of the mechanism and the pulley are loose on the shaft. The clutch levers, of which there are three sets on each pulley, clamp the friction disc between the friction rings, thereby setting the whole pulley in motion. The clutch mechanism is very positive and quick acting, giving immediate control over the pulley.

The friction surfaces of the friction rings are protected by strips of insulated fibre, affording an extra precaution against wear. These strips can be replaced by others at any time, and this portion of the pulley kept as good as new. The bushings are made in halves, and are renewable. They are babbitted, and can be removed and rebabbitted at any time without taking the pulley from the shaft.

The only valid objection heretofore has been that if a friction clutch pulley on the line shaft should slip and require adjustment, the entire line of shafting would have to be stopped for this purpose, or the pulley would have to be thrown out of clutch, losing the work of the machine it was driving until the shaft could be conveniently stopped and the friction of the pulley increased. This objection, it is claimed, has been entirely overcome by the "Imperial" clutch pulley. Owing to its manner of construction, the friction disc is the only part of the pulley that is in motion when the pulley is out of clutch, the clutch mechanism and the balance of the pulley being loose on the shaft. Therefore, should the driving pulley on the line shaft slip at any time, the pulley can be thrown out of clutch and the adjustment of friction effected without stopping the

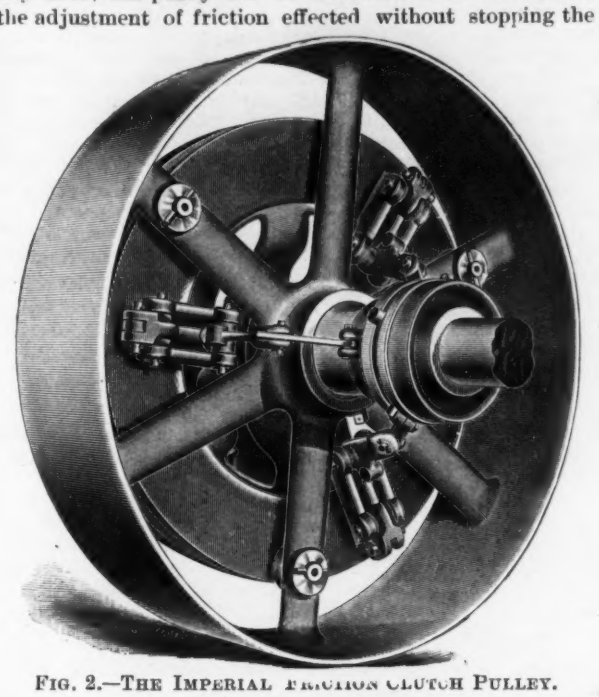


FIG. 2.—THE IMPERIAL FRICTION CLUTCH PULLEY.

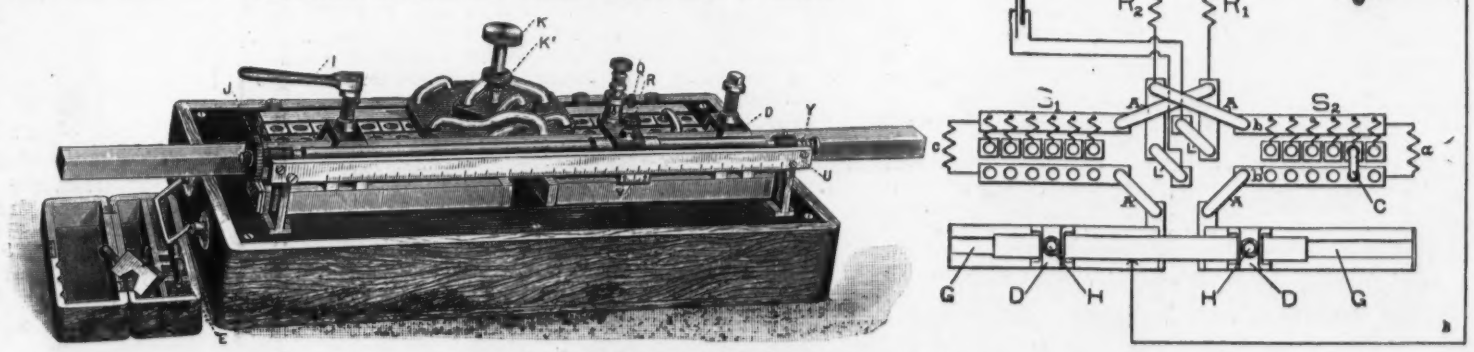
shaft. This feature is of great advantage to any establishment, and especially to electric light plants or works where constant and continuous motion of the line shaft is essential.

This pulley also claims freedom from injurious effects due to centrifugal force. The resistance is in direct line with the strain; consequently centrifugal force does not exert a twisting strain upon the clutch members, nor throw them out of balance. As the friction rings move parallel to the shaft, centrifugal force cannot accidentally throw the pulley in or out of clutch. The permanent balance of the clutch mechanism and pulley being assured, and centrifugal force having no effect on the action of the pulley, there is apparently no limit to the speed at which the clutch may safely be driven.

The large friction surfaces and manner of applying the friction make the pulley very positive and reliable in action, and it will transmit all the power exerted by a belt of the size for which it is made. It is free from complicated devices, has few parts, occupies comparatively small space on the shaft, and is light running and powerful.

A New Conductivity Bridge.

The accompanying figures show in perspective and in diagram a conductivity bridge designed by Queen & Co., Incorporated, of Philadelphia, by means of which the measurement of minute resistances is greatly simplified and freed from many of the errors to which it is commonly subject. The set is handsomely and substantially made, and when complete occupies a rectangular case 22⅜ by 11½ by 8⅜ inches deep. Referring to Fig. 2, R_1 and R_2 are two approximately equal resistances (not necessarily known); S_1 and S_2 represent two groups of resistance, each group consisting of a fundamental resistance connecting together two copper bars, as b and b', and six accessory resistances arranged so that any one can be placed in parallel with the fundamental. One end of each accessory resistance is joined to a mercury cup between the two outside bars; a small copper connector, C, joins the mercury cup to the lower bar as shown in the diagram. These fundamental resistances are initially adjusted very accurately, so that the two groups will differ in resistance by the decimal engraved below whatever cup the connector, C, is bridged into. A, A, A, A, are heavy copper connectors making connections between the various copper bars as shown.



FIGS. 1 AND 2.—A CONDUCTIVITY BRIDGE.

These connectors are carried by a heavy rubber plate as shown in Fig. 1.

In the front of the apparatus is a massive pair of ways, G, upon which slide massive clamps, D; each of these ways is joined, as is evident from the diagram, to one of the groups S_1 and S_2. The connector to be tested, H (Fig. 2), seen as a square bar in Fig. 1, is slipped into the heavy clamps, D, and clamped down by means of the screw nut H and wrench I. A scale, U, 50 centimetres long and divided into millimetres, is supported in front of the test piece as shown in Fig. 1. Upon a rod behind this scale moves a slider by which galvanometer contact is made upon the test piece. A fine adjustment of the slider may be obtained by means of the micrometer screw, T. The vernier, V, allows settings to be made to $\frac{1}{10}$ millimetre.

This method of operation is very simple. The test piece being in position, connector C is placed in such a cup as will make S_1 and S_2 differ by about the resistance of the test piece. A few trials will determine this, or the resistance of the test piece as given by any wire table will be close enough. Battery and galvanometer circuits being connected as shown, the slider is moved along until no deflection of the galvanometer is produced, when the circuits are closed. The heavy connectors A, A, A, A, are now rotated through 180 degrees; this is accomplished by merely lifting the head, K, of the plate which suports them and turning it through the above angle. The smaller plate, carrying connectors L, L, will thus be rotated so as to leave L, L, in the same relative position. The effect of rotating A, A, A, A, will be, as is evident on tracing out the connectors, to exchange S_1 and S_2, and this, obviously, will push the position of the slider contact, corresponding to zero galvanometer deflection, along the test piece, until the amount of test piece moved over equals in resistance the difference between S_1 and S_2. All that must be done, therefore, is to take two balance readings; the length of test piece moved over equals in resistance whatever difference may be originally established between S_1 and S_2.

All contact errors, where the test piece is clamped in, are eliminated in this apparatus; e.g., any contact resistance in the left hand clamp merely operates to throw both balance readings to the right, leaving their difference unchanged.

The entire apparatus being constructed of copper, thermal currents will not usually be of any appreciable moment. They may be eliminated, however, by reversing the battery and taking the mean of two readings as the true slider readings. That is easily accomplished by lifting head, K, and rotating connectors, L, L, through 90 degrees.

To accommodate conductors of different sizes and shapes a number of little adjusting blocks, E, are provided; these blocks fit into the clamps, D, and hold the axis of the test piece, whether round, square or otherwise shaped, in cross-section exactly in the axis of the clamp. With this apparatus the conductivity of copper bars up to ¾ inch in diameter and less than 12 inches long may be measured with an accuracy of $\frac{1}{10}$ of one per cent. The resistances, R_1 and R_2, and S_1 and S_2, are standards, permanently a part of the apparatus and guaranteed accurate to $\frac{1}{100}$ of one per cent.

The Schefbauer Safety Trolley Fittings.

Besides quieting the apprehensions of the public, street railway managers are beginning to find it to their own financial interest to adopt safety overhead fittings that will obviate burnt out armatures or severe strains on generating machinery, and, in case of a broken wire, will throw out only one section of the line instead of paralyzing traffic over the entire road. Considerable study has been devoted by inventors to this subject, with the result that a large number of fittings of this character has been patented. Leaving aside the crudeness of many of the designs, the expense of many others has deterred railway managers from taking up the matter when otherwise they would have viewed it with favor.

Keeping in view the necessity of producing safety devices whose cost would not be prohibitive, Mr. R. Schefbauer, electrical and mechanical engineer, 387 Main street, Paterson, N. J., has designed and placed on the market a line of safety overhead fittings that compare very favorably in cost with those in which the element of safety is lacking; as to their design, the well known ability and skill of Mr. Schefbauer, who was formerly expert of the Edison arc lamp department and has had 20 years of experience in various branches of electrical engineering in responsible positions, is sufficient evidence that nothing is lacking in this respect. There are two forms of circuit breakers. The one consists substantially of a knife switch arm hinged on each side of a central insulating piece; in the centre of the latter is the suspension connection on which are the knife contacts; the trolley wire is secured as usual to a groove in the bottom of the arms. When the trolley wire is taut, a projection on each arm enters into

the corresponding contact on each side of the central piece; and if the wire breaks, the weight of the arm and broken portion causes the arm to leave the contact and thus breaks the circuit. The insulated portion is of a specially prepared fibre which has a working resistance of two megohms, and each circuit breaker is subjected to a pull of five tons before it leaves the factory. One of the notable advantages of these circuit breakers is that the trolley, in passing over the circuit breaker, gives a slight motion to the arms which always keeps the contact in good condition, and prevents the hinge from becoming stuck. Owing also to this flexibility, the trolley wire is prevented from giving way at the edge of the groove, as is often the case with ordinary forms of circuit breakers. The circuit breaker has a capacity for 200 amperes.

As will be readily seen, this circuit breaker admits of the trolley being divided into sections which may be only 100 feet in length. In case of a break in the trolley, only one of these sections will therefore be thrown out, the other parts of the line remaining in use; any danger to life or to the generating machinery is also entirely obviated, as contact is broken and the wires become dead before the ends have fallen any distance.

Another form of circuit breaker is made to be placed at longer intervals, such as 1,000 feet or over. In this form there is a contact piece near the end of each arm of the circuit breaker; these pieces are normally embraced between two parallel springs secured to the central or suspension portion of the circuit breaker, which form a bridge for the current to pass from one section of the trolley to the other. The two arms, rigidly secured to a central fibre piece, are free to move a certain distance in the suspension portion; when the trolley wire is taut, the arms are in a central position, and the contact pieces are embraced by the spring; but if the wire is broken, the strain on one side being released, the arm is drawn toward the other side, and the contacts thus withdrawn from between the springs.

The principle of the circuit breaker first described has been applied to cross-overs, which are also now being manufactured, as well as a new form of section insulator.

Financial Intelligence.

THE ELECTRICAL STOCK MARKET.

New York, July 15, 1893.

Two electrical stocks, Western Union and General Electric, furnished a good part of the week's transactions in the stock market. In fact, the course of their quotations, especially the declines in General Electric, furnished by far the most sensational features of the slump recorded in the earlier part of the week ending to-day. The weakness in these two stocks was induced in the first instance by causes similar to those influencing the entire list, but yet in both cases there were special factors affecting their market values. Both stocks showed clearly evidences of liquidation on the part of some heavily loaded investor, and the selling was accompanied by liquidation in other quarters of such a character as to attract renewed attention to the report published in this column last week, that the outpourings of General Electric and Western Union shares came from Vanderbilt sources. No other interests were of such consequence as to fully explain the free and easy sales made.

General Electric closed on Monday at 70¼; Tuesday its closing quotation was 61¾, and on Wednesday it was 62⅜. To-day's closing quotation is 63⅝, a loss for the week of 7⅛ points. The officers of the company affect to regard the decline as a mystery. They state that the quick assets of the General Electric Company are four times as great as the floating liabilities, and they profess themselves unable to understand how anybody would be willing to sell the stock short or even to let go of it (unless actually obliged to realize on their holdings) in the face of the splendid exhibit of earnings made only a week ago, when the company reported net profits for five months of $1,751,729. The fall in the stock was at one time accompanied by the report that the General Electric Company was a heavy indorser of the paper of the Chamberlain Investment Company, of Denver, Colo., that failed this week for several millions of dollars. It was stated that the two corporations were jointly interested in the promotion of electric railway schemes in the West, and that the General Electric Company had become deeply involved in these ventures. The prompt and emphatic denial that was given to these fallacious statements by President Coffin and his associates quickly put a rest to them. Apropos of the splendid condition of this corporation, it comes from semi-official circles that the company is now doing a business of over 80 per cent. One month ago the General Electric Company owed in short term bills $150,000 only, and in single name paper of long dates less than $2,500,000. By reason of the way in which the subordinate companies are held responsible for a good deal of the business, the floating obligations of the General company are kept at a comparatively small figure.

Western Union's loss for the week is 2⅛ points. Bear tips in any quantity continue to be current. Liquidation on a considerable scale was again clearly noticeable throughout the week, and the story of Vanderbilt selling off Western Union in order to buy Reading Railroad shares again found many believers. The point is made that, compared with General Electric, an 8 per cent. dividend stock, Western Union, which pays but 5 per cent., is ruling at an extravagant figure. Naturally comparisons of this character do not count for much in such a market as now exists, but it is strange that there should exist such a discrepancy in the value of the two leading electrical stocks. One stock market rumor has it that Mr. Addison Cammack and his immediate followers are short of a good line around 81 and under, and that they contemplate a drive at its quotation. Mr. Cammack has been, it must be admitted, open in his bearish views on the stock. People connected with the company state there is no special decrease in net earnings. Mr. Russell Sage denies that he or his friends have, as has been charged, sold their Western Union stock or endeavored to depress its value. He is as loyal as ever, he says, in his belief in the property. One fact that must affect the earnings of the Western Union Telegraph Company is the increased use of long distance telephones. The constant increase in the use of this means of communication that has followed the improvements made in the system has materially reduced the number of private wires in use, and this is cutting off a big source of revenue to the Western Union Company.

The United Electric Securities Company and the Electric Corporation are neither, as has been recently stated, a part of the General Electric Company, and it might be well here to state the exact financial relations of these corporations. They are only united in the effort to make money. When the General Electric Company undertakes to equip a road or a plant one of these two companies advances the money to pay the bills and takes securities in payment therefor. The Electric Corporation deals only in first-class mortgage bonds. It is the younger of the two concerns, it having been but newly formed. Assessments of 20 per cent. each were called in March and May and another will probably be made before Aug. 1 next. The United Electric Securities has already issued nine series of bonds of $1,000,000 each on the securities in its possession and contemplates another early issue.

The Westinghouse Electric and Manufacturing Company is in a very prosperous condition. Net earnings for March, April, May and June of this year are reported to be over $1,000,000. Transactions in this stock, both in Pittsburgh and Boston, have not recently been of such a character as to attract attention.

The American Bell Telephone Company pays to-day a regular dividend of $3 per share, and an extra distribution of $3 more to stockholders of record on June 30. The transfer books open again to-day after 12 o'clock.

The Edison Light and Power Company, of San Francisco, Cal., many of whose stockholders are Eastern investors, has declared a regular monthly dividend at the rate of 8 per cent. per annum on the capital stock. It is payable on and after to-day, July 15.

The Penn Electric Company's minority stockholders have applied to the New Jersey courts for a receiver for the company, on the claim that its valuable franchises are being operated by the majority interest in favor of the Electric "Trust" in such a way as to make the Penn Electric Company show deficits in earnings, thereby rendering the stock practically valueless.

ELECTRICAL STOCKS.

	Par.	Bid.	Asked.
Brush Ill., New York	50	25	30
Detroit Electrical Works	10	2	3
East River Electric Light	100	..	65
Electric Con. & Supply Co. pref.	15	15	16
" " " " " com	15	15	17½
Edison Electric Ill., New York	100	108	106
" " " 1sts	...	105½	106
Edison Electric Ill., Brooklyn	100	95	100
" " " Boston	100	115	130
" " " Chicago	100	220	230
" " " Philadelphia	100	120	140
Edison Electric Light of Europe	..	2	6
" Bonds	..	80	85
" Ore Milling	..	5	12
Fort Wayne Electric	..	123½	123¾
General Electric Company	100	63⅝	63¾
" " deb. 5's	..	79½	80
Interior Conduit and Ins. Co	100	30	40
Mount Morris Electric	..	..	65
Westinghouse Consolidated	50	18	22
" " pfd	50	37½	42½
Western Union Tel	100	79	79½

AFFAIRS OF THE COMPANIES.

The Tyrone Electric Light Company elected the following officers: President, S. S. Blair; vice-president, G. L. Owens; secretary, G. H. Garner; treasurer, D. S. Kloss.

The Richmond (Ind.) Light, Heat and Power Company has permanently organized by electing J. E. Lowes, president; James M. Starr, vice-president; J. W. Roney, secretary, and J. C. Reber, treasurer.

The West End Street Railway Company.—The gross earnings for June were $625,000, against $597,000 in 1892, an increase of $27,000. This amount represents the largest earnings in the history of the road by $25,000. The stock is paying an 8 per cent. dividend, and is selling at only three points above par.

The Brooklyn City Railroad Company has notified its stockholders that it will increase its stock by 300,000 shares at $10 each, or $3,000,000 worth. The number of shares already in existence is 900,000. The additional shares will not be issued until next October. They are issued to stockholders at par value, $10 per share. They are worth in the market $20 per share.

The Albany (N. Y.) Railway Company's application for permission to increase its capital stock from $1,125,000 to $1,500,000 was granted by the State Railroad Commissioners. The reason given for the increase is the cost of improvement and betterments necessitated by the change from horse to electric motor power and the purchase of the Watervliet railway plant. The road reports its cost to date at $1,774,737.58; outstanding indebtedness, $1,730,000; excess of assets over this, $44,737.

NEW INCORPORATIONS.

The Macomb Electric Company, Macomb, Ill., capital stock $30,000, has been formed to supply light, heat and power. J. H. Cummings, H. W. Cummings and Chas. Kettron are interested.

The Chicago & Central Indiana Railway Company of Chicago, Chicago, Ill., capital stock $5,700,000, has been organized. G. A. W. Kintz, N. D. Pontius and G. S. Foster are the promoters.

The Hightstown Electric Light and Power Company, Hightstown, N. J., capital stock $50,000, has been incorporated. J. Shields, Flemington; N. W. Bindsell and R. H. McCarter, Newark, N. J., are interested.

The York & Manchester Electric Railway Company, York, Pa., capital stock $50,000, has been organized to construct and operate a railway. Those interested are C. H. Meyer, G. P. Smyser and Geo. S. Billmyer.

The York & Wrightsville Electric Railway Company, York, Pa., capital stock $75,000, has been incorporated for the purpose indicated in its title. The promoters are Grier Hersh, L. A. Marshall and Chas. H. Mayer.

The Crouse-Tremaine Carbon Company, Fostoria, O. capital stock $100,000, has been formed to manufacture and sell carbons and carbon specialties. J. B. Crouse, H. A. Tremaine, Ira Cadwallader, R. Crocker and A. Emerine are the parties interested.

The Excelsior Electric Light Company of Tarrytown, Tarrytown, N. Y., capital stock $50,000, has been formed to generate and use electricity for light, heat and power. S. Dana Greene, Geo. W. Davenport, both of New York City, and Frank P. Slade, Brooklyn, N. Y., are the promoters.

Special Correspondence.

NEW YORK NOTES.

Office of The Electrical World,
167-176 Times Building, New York, July 17, 1893.

Mr. J. M. Orford, of the Boston Electric Light Company, was in New York last Thursday calling on the trade.

The Brooklyn trolley roads have lessened the traffic of the elevated roads and the latter have applied for a reduction in their assessment.

Prof. Philip Ten Eyck died at Albany on July 15. Dr. Ten Eyck was associated with Prof. Henry at the Albany Academy in electrical experiments.

Mr. T. H. Brady, of New Britain, Conn., manufacturer of mast arms, was in New York, Wednesday of last week, looking up business in this vicinity.

The New York Board of Electrical Control will permit the use of centre poles in wide streets and curb poles in narrow ones for trolley guard wires.

The Electrical Workers' Union is still at loggerheads with the Bricklayers' Union, the latter refusing to permit the former to cut holes in brickwork.

The General Electric Company will transfer its Boston electric railway offices to 44 Broad street, New York City, the present month, and it is rumored that all of the Boston offices will follow.

Mr. R. E. Gallaher, secretary of the New York Insulated Wire Company, has returned to the city from a trip of several weeks West, during which most of his time was passed in Chicago and the World's Fair.

Mr. T. H. Dallett, of Thos. H. Dallett & Co., Philadelphia, was in the city Thursday of last week in the interests of his company. Mr. Dallett reports business good throughout the territory covered by his company.

J. H. Rhoteham el, Esq., president of the Columbian Incandescent Lamp Company, St. Louis, Mo., and F. H Prentiss, Esq., president of the Buckeye Electric Company, Cleveland, O., are spending a few days in New York after visiting the World's Fair.

The Brooklyn Subway Commission proposes, if possible to have the trolley cars in that city provided with a safety sliding platform in front, such as is in use on the cars in Boston. The plat form is a little lower than the floor of the car, and is intended to trip up a person with whom it comes in contact, causing him to fall on the platform instead of under the car.

Brooklyn, N. Y.—The State Railroad Commission will give a hearing in the Common Council Chamber in Brooklyn at 2 P.M. July 25, in the application of the various street railways to use electricity as a motive power. This includes the Kings County Electric Company, The Nassau Electric Railroad Company, The Broadway Railroad Company, The Coney Island, Fort Hamilton & Brooklyn Railroad Company, and the Broadway Ferry & Metropolitan Avenue Railroad Company.

The American District Telegraph Company, in New York, is making contracts for the care and maintenance of the various electric apparatus generally used in stores and private houses. The company has experts and workmen already in its employ for that purpose. The company has now 30,000 subscribers and estimates that at least a third of these will be glad to avail themselves of the opportunity of immediate help in case of derangement of electrical apparatus.

The F. P. Little Electrical Construction and Supply Co. of Buffalo, N. Y., through its general traveling representative, Wm. F. Breidenbach, has completed arrangements in this city and vicinity for opening an agency for the sale of the Kester arc lamp and other specialties manufactured by this company. Mr. F. S. Blackall, 126 Liberty street, will hereafter represent the company in the territory above mentioned. Mr. Blackall is well known as an energetic worker in the electrical field, and it may be expected will place the Kester arc lamp, which already has a well known reputation, among the trade generally.

Mr. Thos. H. Fearey, who was connected with the Chicago office of the Thomson-Houston Electric Company, and later had charge of an office in Louisville for that company, was transferred about 18 months ago to the railway department of the General Electric Company in New York State. He has a very pleasant office in the new Erie County Savings Bank Building, Buffalo. There were not over 10 miles of street railway equipped electrically in Buffalo when he began; to-day there are more than 200 miles equipped entirely with General Electric motors and generators within a radius of 21 miles about his office as a centre.

Mr. James B. Olson, well and favorably known to the electrical trade, and who for the past seven years has been connected with the New York Insulated Wire Company, has left New York to permanently locate in Chicago, where he assumes the position of manager of the Chicago office of the company. Mr. Olson has been with the company almost from its inception, has grown up with the business, and his promotion to the important post of manager of the company's Western branch is well merited. Mr. Olson goes to his new field of labor thoroughly versed in all the requirements of the trade, and his departure is regretted by a large patronage, which he has built up for his company in New York and vicinity, many of whom were exclusive customers. Mr. Olson is entitled to the fullest measure of success in his new field.

NEW ENGLAND NOTES.

Branch Office of The Electrical World,
Room 91, Hathaway Building, 620 Atlantic Ave.,
Boston, Mass., July 15, 1893.

The United Electric Security Company will soon issue Series 10 of $1,000,000 bonds.

Mr. H. G. Carter, manager of the H. & H. Electrical Company, dealers in dynamos and motors, has moved to No. 42 Oliver street, Boston.

The F. E. Belden Mica Mining Company.—The regular monthly dividend of the company will be paid July 17 to stock holders of record July 10.

John H. Withington & Co.—This company has recently opened an office on No. 97 High street, Boston, Mass., and will confine its business to electrical supplies.

The Bridgeport Railway Company has been formed, with General Watson as president. The new company will absorb the existing roads now operating in Bridgeport.

Mr. W. J. Policy has opened an office and store at No. 12 Ferry street, Malden, Mass., and proposes to sell electrical books and supplies, besides doing a general electrical engineering and contracting business.

Arthur T. Woodward, said to be an inventor of an underground electric railway system and an electrical transmission of power system, died on July 13, at Lynn, Mass., from the effects of

drinking two ounces of wintergreen. It is supposed to be a case of suicide.

G. H. Eaton & Co.'s large factory in Stoneham, Mass., was totally destroyed by fire. The loss will estimate $100,000. This company are at present located on Mt. Washington street, Boston, and manufacture machinery for electrical and other purposes. The firm are doing well, and the step to move to Stoneham was taken to give them more room. The blow to Mr. Eaton is a very severe one.

The General Electric Company may move its plant from Boston. The Boston *Advertiser* says, concerning the rumor, that all the offices of the General Electric Company on Atlantic avenue, this city, will shortly be removed to the mammoth Edison Building on Broad street, New York." A gentleman prominent in the company said: "The matter has not been definitely decided as regards our whole force; the railway department will be transferred to New York during the present month."

PITTSBURGH NOTES.

PITTSBURGH, July 15, 1893.

To-day the new electric line from Pittsburgh to Braddock, over the tracks of the Second Avenue Passenger Railway Company, started operations with the most successful prospects.

The Detroit (Mich.) Star Tower Company has been awarded the contract by the Allegheny City authorities of taking down all the electric towers in that city. In the future all the arc lamps of the lighting plant will be suspended from mast arms.

A number of manufacturing concerns from this part of Pennsylvania are contemplating a removal of their works to Niagara Falls in order to avail themselves of the facilities afforded there by electric power from the large electric power plant now under construction. The Pittsburgh Reduction Company, engaged in the manufacture of aluminum, is one of them, which even now is making the change. The Ward's Radiator Company, which will employ 600 men in the manufacture of a dry closet system, heaters, furnaces and radiators, is another, and a third of importance is the Liverpool Pottery and Dresden China Works. They have purchased a site near Buffalo and will build their works there in order to obtain the advantages of electricity in the operation of their factory.

WESTERN NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
936 MONADNOCK BUILDING, CHICAGO, July 15, 1893.

R. A. Drummond, superintendent of the Harter Electric Company, Chicago, lost his life in the recent fire in the World's Fair grounds.

The Chicago Belting Company's new catalogue is one of the souvenirs that visitors to the Electricity Buildings seem inclined to carry away.

Clark & Marshall, of 345 Rookery, are meeting with unusual success with their fan motors. They find it difficult to keep up with their orders.

The Electric Appliance Company has been working for some time in the telephone line with the idea of getting up a first-class non-infringing electric telephone. It claims to have at last succeeded in securing an instrument that is satisfactory to itself, which is a sure guaranty that it is a first-class instrument.

Taylor, Goodhue & Ames have recently issued a very complete and handsome catalogue of the supplies and materials which they handle in such large quantities. The exhibit of this well known house at the World's Fair is now in good shape, and they are ready to welcome their many friends either at the exhibit or at their cool, roomy office, 348 Dearborn street.

Willis L. Adams, formerly connected with the Railway Equipment Company, of Chicago, has opened an office at 84 Adams street. Mr. Adams enters business for himself as a manufacturer of electrical apparatus, his specialty being the application of electric power to all classes of machine tools. Mr. Adams has a host of friends throughout the country, who wish him every success.

The Royal Columbian Electric Company has opened offices at 53 Dearborn street, Chicago, where Mr. H. R. Fish, Jr., is prepared to meet all those who are looking for alternating current machinery. Although this apparatus has been on the market for more than two years, its introduction has been in the nature of actual installations, and now that they have many plants in operation, they are prepared to claim for it all the advantages which practice has demonstrated belong to it.

Low Frequency Fan Motors.—The fact that the Westinghouse company is using very large generators of an unusually low frequency in the World's Fair lighting has proved a stumbling block to the manufacturers of alternating current fan motors in placing their motors on the World's Fair circuit. The Electric Appliance Company has come to the front with a Meston fan motor wound particularly for the World's Fair work, and finds that it is even more efficient than the regular motor. The company is also making arrangements to have the motors rewound after the World's Fair to operate on alternating circuits of ordinary frequency, where it is so desired.

Mr. A. D. Adams, representing the Commercial Electric Company of Indianapolis, Ind., returned to Chicago last week after two weeks' absence in the West, during which time he located agencies for the Commercial motors and dynamos at Omaha, Sioux City, Denver, Colorado Springs and Pueblo. In spite of the present stringency in the money market, the outlook for business is particularly bright in the above territory. The policy of this company has been from the start to sell, as fast as possible, through local construction and supply houses throughout the country, and it is the intention to locate further agencies as far as possible in all parts of the United States where they are not now represented.

CLEVELAND, O., July 15, 1893.

At the meeting (monthly) of the Civil Engineers' Club of Cleveland July 11, Prof. E P. Roberts gave an hour's talk on the subject of Preliminary Surveys for Electric Light Stations.

The Cleveland City Railway Company is at work on the Rocky River line and expects to have it in running order by next September. It is expected that the Franklin Avenue line will be equipped with electricity in the course of a couple of weeks.

The Cleveland Electric and Manufacturing Company is doing the wiring for the large addition to the Masonic Building for 650 lights. The addition includes the theatre, having 300 lights, a floor given up to initiatory purposes, a floor for club purposes, a floor for drillroom and the ground floor to stores. Work is being done according to the specifications of E. P. Roberts & Co.

Wm. Hazelton, 3d, has resigned his position as assistant general manager of the Short Electric Railway Company. Mr. Hazelton has recently had excellent opportunities to connect himself with some street railway enterprises which business friends of his have requested him to develop, and he believes that for a young man thoroughly familiar with the business there is a better field in connection with the development in electric street railway lines than in connection with the manufacturing companies.

Thirty-eight employes of that branch of the Cleveland Electric Railway Company formerly known as the East Cleveland Railroad Company were made glad by the receipt of money prizes for efficiency and deportment while in the discharge of their duties. By a resolution passed last January, by the directors of the company, $3,000 was set aside to be distributed among the employés. Of that sum $1,500 was distributed yesterday. Ten motormen and 10 conductors received first prizes of $50 each and 8 motormen and 10 conductors received second prizes of $25 each.

Messrs. Sidney H. Short, Jonathan Potter, L. A. Russell, William C. Scofield and George F. Scofield incorporated and organized the Cleveland Cross Town Street Railroad Company. William C. Scofield, Charles W. Scofield, George F. Scofield, Sidney H. Short and L. A. Russell incorporated and organized the West Side and Gordon Park Street Railroad Company. Each separate corporation will become the owner by assignment of each of the roads mentioned if the City Council will consent to the assignment by the individual grantees of the right to construct and operate the lines. It has been agreed by all the individuals composing the two corporations that the companies shall be consolidated by the State law into one corporation which will build and operate both railroads as a single property. Each original incorporation has a capital stock of only $10,000, so that upon the organization of each the law could be complied with and the certificate made to the Secretary of State that the entire capital stock was, in fact, actually subscribed and paid in full.

OREGON CITY, Ore., July 10, 1893.

Mr. Chas. S. Bowie, of Tacoma, who is connected with the Northwest General Electric Company as construction engineer, was recently in Chicago visiting the World's Fair.

The Portland & Vancouver Railway line is now being successfully operated by electricity over its entire length by the Portland Consolidated Street Railway Company. The line extends from the east bank of the Willamette River in Portland, Ore., to the south bank of the Columbia River opposite Vancouver, where a ferryboat transfers the passengers.

The Sunset Telegraph and Telephone Company has installed two additional sections of switchboard in its Seattle exchange, so that it will have a capacity of 1,500 'phones, and 22 operators will be required. At present each operator tends 160 'phones, but under the new management about 100 will be the average. There are 1,040 subscribers in Seattle at present.

Manager A. J. Clarke, of the Sunset Telegraph and Telephone Company, in Seattle, has announced a 50-cent rate for a half minute's conversation between that point and Portland, Ore., a distance of about 190 miles. About 60 words can be spoken in that time. Heretofore $1.50 has been charged for three minutes' conversation. The system is to be extended to all of the company's long distance lines in time.

The Portland General Electric Company has completed its two-story office and station building in Oregon City. This, with the trainsheds adjoining, will be used as headquarters for the company's West Side Railway line, upon which tracklaying is now in progress. The company's telephone exchange for its private lines is located in the building. The new cars for the electric railway line are now *en route* from Philadelphia.

CANADIAN NOTES.

OTTAWA, July 10, 1893.

The Montreal Street Railway has decided to issue $200,000 new stock at par in the proportion of one share in nine to shareholders of June 30. This will bring the capital of the company up to $2,000,000.

The Reliance Electric Light Company in Waterford, having obtained the permission of the Council to put in an electric light plant in Simcoe for supplying an incandescent service, the local company has decided to do the same.

The Incandescent Light Company, of Toronto, is making large additions to its operating plant. A new brick building for 2,500 h. p. is being erected, and the company has purchased a 700-h. p direct-connected dynamo. These improvements, when completed, will give the company capacity for supplying 10,000 extra 16 c. p. electric lamps. At the present time the company is supplying current to over 25,000 lamps.

Northwest Territories.—The Bell Telephone Company is about to commence work on the reconstruction of its lines at Portage la Prairie, Brandon, Regina and Prince Albert. New poles will be erected and many improvements inaugurated, which in this respect will place these towns and cities on an equal footing with those in the East. The new lines at Neepawa and Carberry have been completed and the Morden system will be finished in a few days.

Halifax, N. S.—On Corbett's Wharf there is a large reel of submarine cable to be laid across the Lennax passage, forming an extension of the lines of the Union Telephone Company of Arichat, now being constructed. This cable is similar to the cables on the lines between London and Paris and Glasgow and Belfast. When the Union Telephone extension is completed they will have about 70 miles in operation connecting L'Ardoise and also St. Peters by another cable across the canal.

The Bell Telephone Company, Montreal, which increased its capital stock by $240,000, at its last monthly board meeting invited its shareholders to take up the new shares, each holder to get one-fifth of a share upon his stock. The limit within which the shares could be taken at par has expired. It is stated that nearly all the shareholders had filed their orders. The company reserves the right to sell those "rights" to shares that have not been taken up, putting such price upon them as it deems necessary.

The Automatic Telephone and Electric Company, of Canada, has just perfected a new telephone instrument. It takes much less space than the telephone at present in use, and is novel and attractive in appearance. The Automatic Telephone Company has added many improvements to its new instrument besides the design. Chief of these is the automatic release, doing away entirely with the necessity of memory on the part of subscriber in releasing after finishing conversation. Another prominent feature is its protection from dust and dirt, it being inclosed when not in use.

The contract for supplying the electric plant at Beauharnois canal to be used in opening and shutting the lock gates, has been awarded by the Government to the Canadian General Electric Company, of Toronto. The installation will be completed in about two weeks, and the test will last a month. It is understood that the Minister of Railways and Canals has definitely decided to adopt electricity as the motive power for opening and closing the gates on the new lock at the Sault. Mr. Schreiber, who returned from Sault Ste. Marie on Saturday, said that he is also well satisfied with the feasibility of the motive power, and that the necessary arrangements are being made for putting an electric plant in.

News of the Week.

THE TELEPHONE.

The long distance telephone will replace on the Pennsylvania Railroad system the telegraph for connecting the offices of the higher officials.

The Automatic Telephone and Electric Company, it is reported, will build a telephone line from Halifax to Vancouver a distance of 3,500 miles.

ELECTRIC LIGHT AND POWER.

Geneseo, N. Y., has voted in favor of electric lights.

Jefferson, Ia.—The town has voted for a municipal plant.

Lexington, Ill.—The electric plant of Lexington is for sale.

Hamilton, Mont.—John Johnson will erect an electric light plant.

Washington, N. J.—John Karr has secured a contract for lighting the town.

Garfield, Wash.—W. F. McCasky has the contract for the municipal lighting plant.

Oelwin, Ia., by a vote of 210 to 18 decided in favor of granting an electric light franchise.

Morenci, Mich.—The village has decided to establish a municipal electric-lighting plant.

Worthington, Minn., has voted in favor of bonding the village for an electric lighting plant.

The Uxbridge, (Mass.) & Northbridge Electric Company is to increase its local plant.

Fairfield, Ia., has granted an electric light franchise to the Fairfield Gas and Electric Company.

The Tacoma Light and Water Company has sold its entire plant and rights to the City of Tacoma.

The Hightstown, N. J., Electric Light Company proposes to furnish light to Wilbur and surrounding villages.

Plainfield, N. J.—The Common Council will soon call for bids for putting electric fixtures into the new Fire Department House.

Rome, N. Y.—Mr. C. O. Mailoux, of Cedar street, New York, has been engaged to present figures on the cost of a municipal plant.

Weston, W. Va.—The Weston Electric Light, Water and Power Company will rebuild the plant recently destroyed by fire.

McKeesport, Pa.—The city authorities have decided to buy property as the site for an electric light plant and a garbage furnace.

Waterloo, Ia.—E. L. Johnson, Mart Wyant and O. C. Miller have purchased the Waterloo electric light plant of Messrs. Jones & Josselyn.

Chester, Pa.—Upon the suggestion of Councilman Pennington, an estimate of lighting South Chester town hall with electricity is to be secured.

Glens Falls, N. Y.—The business men of South Glens Falls have petitioned the street railway company to build a branch road to their village.

Richmond, Mo.—The Hamacher flouring mill and the city electric light works were destroyed by fire. The total loss is $15,000; insured for about $15,000.

Niles, Mich.—A special election will be held to vote on proposed issue of $100,000 in bonds for building a combination electric lighting and water plant.

Jamaica, L. I., N. Y.—The Committee on Public Lighting has been empowered to advertise for bids for gas and incandescent and arc electric lights for the village.

Ludlow, O.—Only one bid for electric lighting was received, and that was returned to the bidder unopened, and the time for receiving bids was extended thirty days.

Hoboken, N. J.—The Board of Freeholders of Hudson County have adopted a resolution to return all bids for lighting the public road to the bidders who tendered to furnish a plant.

Mount Pleasant, Pa.—The Electric Light, Heat and Power Company have taken steps to increase their capital stock from $5,000 to $20,000, to cover the arc street light addition to their plant.

Bristol, Conn.—The local electric light company has bought a plot of land next to its building, upon which they will build an addition to their factory, put in a new boiler and generally increase the size of their plant.

Excelsior Electric Company has sold its entire lighting plant to the Tarrytown (N. Y.) & Irvington Union Gaslight Company, so that henceforth there will be no competition in the illuminating of these villages.

Binghamton, N. Y.—The Council will act at the regular meeting, July 31, on proposals for supplying the city with 250 arc 2,000-c. p. and 70 or more gas lights. Proposals will be submitted for one, two or three years,

Etna, Pa., will vote on Aug. 22 in the matter of issuing bonds to the amount of $100,000, of which $15,000 will be devoted to the purchase of an electric lighting plant for the borough, to be operated in connection with the water works plant.

Belmont, Cal.—An electric plant will be put in to provide light and power for the Reid School. The Hopkins Academy of Oakland and the Reid School of Belmont have consolidated. The cost of improvements will be $30,000. W. T. Reid, president.

Easton, Pa.—The ordinance for a bond issue of $28,800 has been amended by Select Council and cut down to $20,000. There is included in the $20,000 to be issued $2,500 for a new dynamo and for the extension of the city's electric street-lighting service.

Madison, Wis.—Sealed proposals will be received at the office of the City Clerk to Aug. 1 for the erection and installation of an electric arc light plant of 150 double service lights with a capacity of 200 lights, the ground and buildings to be furnished by the city. O. S. Norsman, City Clerk.

The Monument Mills Company, Housatonic, Mass., will transmit 300 h. p. of electric power a distance of one mile to their new mill. The same circuit will be used for 1,000 incandescents, 20 arcs, two 40-h. p. and three 10-h. p. motors. The Stanley-Kelly two-phase system will be used.

The Galesburg (Ill.) Gas Light and Coke Company, at Galesburg, certified to a consolidation with the Merchants' Electric Illuminating and Power Company, at Galesburg, the new company to be known as the Galesburg Gas and Electric Light Company, with a capital stock of $200,000.

Asbury Park, N. J.—The Seashore Electric Light and Power Company proposes to conduct its business all along the shore from Long Branch to Hanasquen. The objects are to make, sell, and furnish electricity for purposes of electric lighting, heating and power. The capital is limited to $250,000. Isaac C. Kennedy, of Asbury Park, can be addressed.

The Knickerbocker Electric Light Company, through Richard Ficken, its president, has made application to the Town Board of Flatbush, L. I., for a franchise to supply the town with electric light and power. At a meeting of the board on Wednesday last it was resolved that the application be advertised, and a public hearing given on July 21.

Toledo, O.—Sealed proposals will be received until Aug. 7 for lighting any part or all of the streets, alleys, bridges, public grounds and buildings of the city of Toledo, and to furnish light for a period to private consumers for a period of one, two, three, four or five years, from Jan. 1, 1894, with electric lights on both the daily and moonlight schedules. The arc lights are to be of nominal 2,000 c. p. Sylvester Lamb, City Clerk.

THE ELECTRIC RAILWAY.

The Ossining (N. Y.) Electric Railway will be extended to Sparta.

The Norwich, (Conn.) Street Railway Company proposes to extend its electric lines.

Shenandoah, Pa.—Contractor Egan has begun work on the grading for the Lakeside Electric Railway.

Dansville, N. Y., has granted an electric railway franchise to the Dansville Electric Railway, Dedham, Mass.

Castleton Corners, Richmond County, N. Y.—There is talk of operating the electric road to Brighton by electricity.

Wellesley, Mass.—The Selectmen will give a public hearing July 22 on petition of Wellesley & Boston Street Railway for right of way.

Cambridge, Mass.—The West End Railway is before the Board of Aldermen with a petition for leave to extend their trolley system to Old Cambridge

Tyrone, Pa.—The Tyrone Electric Street Railway Company has been granted right of way for an electric street railway through certain streets for an electric road.

Milliston, Mass.—Fire in the carhouse of the Quincy & Boston Street Railway Company burned one construction car, two snow plows and a quantity of tools and one box car.

Clayton, Mo.—The Clayton and Forest Park Electric Railway Company has increased its capital stock from $60,000 to $100,000 and issued a call for 50 per cent. of the stock subscribed.

The Lehigh Valley Traction Company, Bethlehem, Pa., has graded its new road from West Catasauqua to Salisbury. The road is being pushed to Bethlehem as rapidly as possible.

The Paterson (N. J.) & Little Falls Electric Railway, Grand Street Railway and People's Park companies, in Paterson have consolidated. The stock of the new company is $250,000.

York, Pa.—It is likely that the York & Wrightsville electric line will be extended to Middletown Ferry, thence by bridge across the river to connect with the Steelton, Highspire & Middletown line.

Dansville, N. Y.—A franchise has been granted to the Danville Electric Street Railway Company, reported here as incorporated May 16, $50,000, D. O. Battersby, C. H. Rose and Wm. Kramer, of Danville.

Centralia, Ill.—The stockholders of the Centralia & Central City Railway Company have voted to increase the capital stock of the road to $30,000, and to spend $20,000 to be used for extensions and equipping with electricity.

Baltimore, Md.—The Lake Roland Elevated Railroad Company is preparing plans for the erection of an immense car house, to be located at Walbrook and to be built of stone and iron. It will be equipped with all modern appliances, and will include offices and repair shop.

Martinsville, Ind.—After a protracted legal fight the County Commissioners granted the petition of the Indianapolis & Martinsville Electric Railway Company asking that a vote be taken on the question of issuing $48,000 worth of stock. The road will be built to Indianapolis, a distance of 30 miles.

Provincetown, Mass.—The petition of Isaac N. Fellows, of Natick, Mass., for leave to build an electric railway through the streets here has been granted, Mr. Fellows acting for the General Electric Company. It is further stated that other parties stand ready to build an extension of the road to Ballston Heights.

The Chautauqua County (N. Y.) Farmers' Alliance has passed the following resolution: "That we recommend the investigation of the electric railway system as a means of both freight and passenger traffic as a more economical and rational measure than the proposed designation and building of county roads."

Xenia, O.—It is reported that the electric road between Springfield, O., and Xenia is an assured fact as soon as the right of way can be secured. The capital is all pledged and the road will be built when the right of way is secured. Mr. Wayne Neff, who is back of the enterprise, is already looking over the ground to secure the right of way.

Newark, N. J.—There is now some doubt about the extension of electric roads beyond the Newark limits in Essex County. The railroad companies do not see much prospective profit in suburban travel under any circumstances, and the township committees while really desiring the improved facilities, impose restrictions which are, it is claimed, prohibitory in character.

The Norfolk Suburban Street Railway Company has effected a permanent organization, and elected the following board of officers: President, John R. Bullard, of Dedham, Mass.; secretary and treasurer, Thomas T. Robinson, of Dedham. Mr. Robinson will be superintendent of the road, and Erastus Worthington, Jr., will be its engineer. A call for a second assessment, one of 40 per cent., will be made. The stockholders have already paid in the first assessment of 10 per cent. Nearly all the material for construction has been received and stored at Hyde Park, and the work of building the new electric street railway from Dedham Centre, through East Dednam and Hyde Park, to a point near the Mattapan station in Boston will be pushed rapidly forward to completion. The new officers are sanguine that the road will be in running order by Oct. 1.

LEGAL NOTES.

The Board of Electrical Control is much interested in the suit brought by the Empire City Subway Company against the Broadway & Seventh Avenue Railroad Company to test the latter's right to string telephone and electric signal wires in its cable conduit, as no permit for the stringing of such wires has been asked for or granted, although the wires have been put in place. The board claims the exclusive right to grant such permits, and the Empire company, under its contract with the board, claims the exclusive privilege of constructing underground conduits for low-tension wires. The board can do nothing, however, until the question is decided by the courts.

The American Bell Telephone Company has brought suit in the United States Circuit Court at Cincinnati against the Jones Brothers Electric Company, of Cincinnati, because of the alleged infringement of a patent on an improvement in the structure of speaking telephones, the patent being known as No. 186,787, and granted Jan. 30, 1877. The defendants, it is claimed, have since March 7, 1893, been making and using and furnishing to others for use and sale electric speaking telephones, each of which embraces the invention and improvement on material parts described and claimed in the patent known as No. 186,787. Damages and accounting and all other rights are asked, including perpetual injunction.

The American Bell Telephone Company and E. Berliner have filed their answer to the bill lodged by the Government to annul the Berliner patent, in the United States Circuit Court for the District of Massachusetts. The answer is a general denial of all the charges made in the Government complaint, and avers that due diligence was observed in the prosecution of the case in the Patent Office; that as a matter of fact the patent was ready for issue as early as 1882, and that the patent would then have been issued but for the action of Examiner Brown, who rejected all its claims and raised other objections—all of which could have been done before that date. This action was appealed from to the Board of Examiners-in-Chief, who, in February, 1889, reversed the decision of the examiner. It is also averred, in response to the complaint, that no new matter was introduced into the amended specification filed in 1880, after the acquisition of the patent by the Bell company. The Bell company also aver that in the applications for the Berliner patent all due forms of law were observed, and that the Government cannot repudiate the acts of its own agents established by the laws creating the Patent Office.

MISCELLANEOUS NOTES.

Oak Park, Ill., proposes to put in a fire alarm system.

The Oneida (N. Y.) Street Railway Company has been allowed by the New York State Railway Commissioners to change its motive power to the storage battery system.

A Financial Plan.—Mr. G. P. Altenberg, Cincinnati, has contributed a letter to a recent issue of the Cincinnati "Tribune" proposing an international monetary union by which all moneys could be made stable. The scheme is worked out in considerable detail, and is worthy of careful consideration by everyone who is at all interested in the financial question.

World's Fair electrical judges have been announced as follows: H. S. Carhart, Ann Arbor; H. J. Ryan, Ithaca, N. Y.; P. F. Thomas, Columbus, O.; George F. Barker, Philadelphia; T. C. Meadenhall, Washington, D. C.; Robert E. Owen, Lincoln, Neb.; Michael O'Dea, Notre Dame, Ind.; W. M. Stein, Chicago; Samuel Reber, United States Army; H. A. Rowland, Baltimore, Md.; E. P. Warner, Chicago.

The Chicago & St. Louis Electric Railroad.—The St. Louis *Star Sayings* has the following: Notwithstanding the quiet in Chicago & St. Louis Electric Railroad affairs, work is progressing rapidly. All the contracts are let, that for the construction being given to Bagnell & Garvey Bros., and the electric motors are to be supplied by the General Electric Company. Bagnell & Garvey Bros. have agreed to take half their pay in bonds at par. Arrangements had been made for placing the remainder of the bonds, when the present financial trouble came up. All the bills are paid, however, and the officials of the company claim to have enough money in the treasury to continue work for a year. Dr. Wellington Adams, the general manager of the road, was seen to-day. 'There is one mistake that I wish you would correct," he said. "It has been reported time and time again that we expected the road to be completed in time for the World's Fair. Now, you won't find a single intimation in our prospectus or any of our advertisements that we made any such promise, and we never had any idea of it. In our contract with the General Electric Company they guarantee to put in motors which will give a maximum speed of 100 miles an hour. Everything is moving along well, but I decline to say when the road will be completed, as that is still "an uncertainty." A plan is on foot, it is said, whereby it is probable that the St. Louis & Chicago Electric Railroad will have its route changed so that the road will go through Alton, Ill., and over the Alton bridge.

Trade and Industrial Notes.

F. H. Sparling & Co., 44 Broadway, New York, engineers and contractors, have several street railway plants in course of construction.

Harry S. Smith & Co., Limited, of Philadelphia, have recently installed a new Eddy generator, 150 h. p., in the new foundry of Wm. Cramp & Sons, ship builders, Philadelphia.

The Standard Electric Company, 2246 Ninth street, Philadelphia, has issued a placard showing what distress might be created in Hades by the chilling breezes from one of their "Cyclone" motors.

The Maschinenfabrik Oerlikon, Zurich, Switzerland, have issued a pamphlet devoted to their new alternate current motors and the various electric traveling and other cranes made by this celebrated company.

The Interior Conduit and Insulation Company, 44 Broad street, New York, have equipped Tattersalls' Horse Mart, the Imperial Music Hall, the Hotel Logerot and the New Amsterdam with Lundell fan motors.

Smith & White, 271 Main street, Pawtucket, R. I., have started in business as electrical engineers and contractors. They will do general electrical construction work and propose soon to add a manufacturing branch.

The New York Insulated Wire Company, 13 Cortlandt street, New York, have recently closed an important contract for over 75,000 feet of Vulca duct for E. T. Gerry's new residence, corner Sixty-first street and Fifth avenue.

The Stanley Electric Manufacturing Company, Pittsfield, Mass., has taken the contract to place a 300-h. p. plant in the Monument mills at Housatonic, the energy to be located at the company's new dam, a mile north of the village.

W. R. Brixey, 203 Broadway, New York, has issued a new catalogue of the celebrated Day Kerite insulated wires and cables, which are illustrated in detail. The pamphlet is neatly gotten up and contains a number of tables relating to wires

Hartman & Braun, Bockenheim-Frankfort, Germany, have published a cloth-bound catalogue of their exhibit of electrical instruments at the World's Fair. The items exhibited are 112 in number and are described in English with a number of illustrations.

The Chicago Electric Wire Company of Delaware, Ninth and Parish streets, Philadelphia, have issued a catalogue of their high grade insulated wires and cables, to which is appended 40 pages of wiring tables and other useful information for the wireman.

Bryan, Marsh & Co., 136 Liberty street, New York, have issued a neat catalogue, devoted to the Kolon primary battery and its many applications. Ten new types of cells are announced, in all of which the new carbon cup is used which was lately described in our columns.

The Electrical Engineering Company, Equitable Building, St. Louis, Mo. has been awarded the contract for 6,000 incandescents in the Union Trust Company's fourteen-story building, and for the electric light work in the new Union Depot, one of the largest of its kind in the world.

The Jenney Electric Motor Company, Indianapolis, Ind., has published a pamphlet containing a large number of testimonials as to the merits of its well known machines, coming from firms of excellent standing, such as Proctor & Gamble, of Ivorydale, O., Louisville Electric Light Company, New York & Ohio Company, Warren, O., the Eclipse Bicycle Company, and many others.

Mr. Charles Ludlow Livingston, 121 Fourth avenue, Pittsburgh, Pa., was recently awarded the contract for wiring the new Carnegie Library, now being erected in that city. In a reference to that fact in THE ELECTRICAL WORLD of July 8, by a typographical error Mr. Livingston's name was changed to Wilson. The mistake was, no doubt, readily detected on account of the well known reputation of this contractor.

The Berlin Iron Bridge Company, of East Berlin, Conn., has received from E. D. Leavitt, consulting engineer of the Calumet & Hecla Mining Company, a contract for the iron roof over the new engine-house. The Berlin company has also received a contract for the iron roof on the purifier-house of the Philadelphia Gas Company. The new power-house of the Worcester Traction Company will also be designed and built by the Berlin company.

The Westinghouse Electric and Manufacturing Company, Pittsburgh, Pa., has issued an exceedingly handsome pamphlet describing and illustrating the Westinghouse electric railway apparatus. The pamphlet is bound in beautiful cardboard covers and handsomely printed on a heavy calendered paper of extra quality. All parts of their railway system are clearly explained and the details of the winding and controller given.

The Stirling Company, manufacturer of safety watertube boilers, claims that it has never had a boiler removed for any cause whatever, except one where it removed the boiler before it was erected on account of the bad condition of the purchaser's finances. It has been stated that the Stirling boilers in the Union Trust Building, New York City, were to be removed, but the Stirling company, which has 300-h. p. of boilers in that building, holds a letter from the chief engineer stating that the boilers are perfectly satisfactory in all respects, and that there is not the slightest intention of removal.

The Stucky & Heck Electrical Manufacturing Company has recently started in business at 23 N. J. Railroad avenue, Newark, N. J. The company will do repairing and constructing of dynamos and motors, overhauling and rewinding of armatures, and will give special attention to street car motor work, commutators and electrical appliances generally. The gentlemen comprising the company have had 16 years' experience with some of the leading electrical manufacturing concerns, and engage in business backed by the very best of training and education for the line of work they have taken up.

The Jenney Electric Motor Company, Indianapolis, Ind., from their branch office in Chicago, are doing considerable business, and have recently installed a 200-light plant in the Battle Creek Sanitarium, Mich., and also completed the electrical equipment for the cutting and sewing department of Kuh, Nathan & Fisher, of Chicago, one of the largest clothing firms in the city, and all of whose machines will be run by the Jenney motors. They have also made extensive extensions of the electrical equipments of the Condon Brakeshoe Company, of Chicago, and have just put in 120 and 5-h. p., and also might be mentioned a large number of smaller motors that they are selling daily in this territory.

Among the several orders for tablet boards, manufactured and furnished by J. L. Hays & Co., of Pittsburgh, Pa., recently received are the following: A board of from 700 to 800 circuits, each circuit having a switch of its own, for the Ponce de Leon Hotel, St. Augustine, Fla. This hotel will have 48 tablet boards, divided up into between 700 and 800 circuits, all in cabinet form. Italian marble top, sides and bottom. The main line switches will be the Edison curve lever switch. The circuit switches will be the E. & S. china cover. Also an order from Port Huron, Mich., and one from Atlanta, Ga., the latter a very important one. The tablet boards are being made from designs furnished by Mr. A. J. Best.

The Buyers' Reference Book, published by the Buyers' Reference Company, 114 Nassau street, New York City, N. W. Gage, president, and R. D. McCartie, secretary and treasurer, has appeared for the second quarter of 1893. This publication, it will be remembered, is a "Textbook. Classified Directory and Illustrated Descriptive Catalogue," intended to place in the hands of a buyer a classified collection of information in regard to the various styles of apparatus in which he is especially interested, and to save him a tedious search through a long list of catalogues and advertisements. The cover of the three parts is somewhat changed in appearance, being white in color and ornamented with bronze, which is a decided improvement. The different parts have been increased in size by the addition of considerable matter, and the mechanical and typographical appearance improved.

The Riehle Bros. Testing Machine Company, Philadelphia, Pa., has just received an important order from the civil engineering department of the Cornell University for a 400,000 pound vertical screw power testing machine with all the latest automatic and electric attachments, recording diagram apparatus, and special tools for testing girders up to 18 feet in length, tranversely; also for crushing columns 10 feet high, and for applying tensile strain to rods, bars, etc., 10 feet long, stretching them, if necessary, 25 per cent. of their length before breaking. This machine is, without doubt, the largest screw power testing machine in the country, if not in the world. The Riehle company not long ago placed a horizontal hydraulic testing machine of the same capacity (400,000 pounds or 200 tons) in the Boston Navy Yard. This machine weighs by means of scale levers, and is, no doubt, the largest hydraulic machine with levers in the United States.

Business Notices.

Transformers rewound and repaired. Write for prices. The Hill Manufacturing Company, Salem, Va.

Battery Cut-Out, Cheap.—Sensitive, reliable, never requires attention. Gas lighting much improved by its use. Electric Supply Company, of 105 South Warren street, Syracuse N. Y.

The Western New York & Pennsylvania Railroad Company is the short and popular route from Buffalo to Olean, Bradford, Dunkirk, Mayville, Titusville, Oil City, Pittsburgh, Philadelphia, Baltimore, Washington and the South. It is the only line running solid trains with Pullman buffet and sleeping cars daily between Buffalo, Oil City and Pittsburgh. The general office is at 24 Exchange street, Buffalo, N. Y. Trains leave New York Central & Hudson River Railroad Depot, New York City.